Planning Application Referral Package

Application Type: Agricultural Land Reserve
File Number: 3015-20/C20240020
ALR Application Type: Soil or Fill Use 20.3(5)
Electoral Area: C
Date of Referral: April 22, 2024
Date of Application: April 15, 2024

Property Owner's Name(s): BC Transportation Financing Authority

Applicant's Name: Sitkum Consulting Ltd.

SECTION 1: Property Summary

Legal Description(s): The Fractional South West 1/4 of District Lot 9159, Cariboo District, Except Plans BCP28576, EPP21640, EPP21641 and EPP21642

Property Size(s): 56.39 ha (139.35 ac.)

Area of Application: 56.39 ha (139.35 ac.)

Location: 5302 Bastin Rd

Current Designation:
n/a

Min. Lot Size Permitted:
n/a

Current Zoning:
Resource / Agricultural (R/A)

Min. Lot Size Permitted:
32 ha (79.07 ac.)

Proposal: It is proposed to use the property for the placement of fill from the Bastin Hill Landslide as well as provide aggregate for Ministry of Transportation and Infrastructure projects. Topsoil will be stockpiled and property will be recontoured to be conducive to agriculture upon completion. Fill activities are proposed for two years and extraction activities proposed for 50 years.

Existing Buildings: tin building - 2339.1 sq. m. (25,177.3 sq. ft.)
tin building - 316.3 sq. m. (3404 sq. ft.)

Proposed Buildings: none

Road Name: Bastin Rd.
Road Type: Paved
Within the influence of a Controlled Access Highway: N/A
Services Available: Hydro, well, septic system

Within the confines of the Agricultural Land Reserve: Yes - fully within

Required to comply with the Shoreland Management Policy: N/A
Name of Lake/Contributing River: Quesnel River and unnamed creek
Lake Classification: High

Within Development Permit Area: No

Adjoining Properties: (Source: B.C.A.A.)

	Land Use:	Lot Sizes:
(a) North	Beef, Vacant	80 ha. (197.68 ac.)
(b) South	crown land	n/a
(c) East	mixed, vacant	63.25 ha. (156.29 ac.)
(d) West	Beef	71.22 ha. (176 ac.)

Agricultural Capability Classification:
Canada Land Inventory: Class 1 = Best, Class 7 = Worst

% of parcel	Unimproved rating	Improved rating
35%	60% Class 5- Moisture limitation and Topography limitation 40% Class 5- Topography limitation and Moisture limitation	100% Class 4- Topography limitation and Moisture limitation
35%	80% Class 4- Moisture limitation and stoniness 20% Class 5- Moisture limitation and stoniness	80% Class 3 – stoniness and moisture limitation 20% Class 4- stoniness and moisture limitation
		No Improved Class

15%	100% Class 7- Topography limitation and Erosion	No Improved Class
10%	100% Class 7- Topography limitation	
5%	70% Class 5- Moisture limitation and stoniness 30% Class 4- Moisture limitation and stoniness	70% Class 4 – stoniness and moisture limitation 30% Class 3- stoniness and moisture limitation

The agricultural capability classifications of the property are Class 4, Class 5 and Class 7. The limiting factors are noted as moisture limitation, topography limitation, and stoniness.
Land in Class 4 has limitations which make it suitable for only a few crops, or the yield for a wide range of crops is low, or the risk of crop failure is high, or soil conditions are such that special development and management practises are required. The limitations may seriously affect one or more of the following practises: timing and ease of tillage, planting and harvesting, and methods of soil conservation.

Land in Class 5 is generally limited to the production of perennial crops or other specially adapted crops. Productivity of these suited crops may be high. Class 5 lands can be cultivated and some may be used for cultivated field crops provided unusually intensive management is employed and/or the crop is particularly adapted to the conditions peculiar to these lands. Cultivated field crops may be grown on some Class 5 land where adverse climate is the main limitation, but crop failure can be expected under average conditions. Note that in areas which are climatically suitable for growing tree fruits and grapes the limitations of stoniness and/or topography on some Class 5 lands are not significant limitations to these crops.

All classified areas not included in Classes 1 to 6 inclusive are placed in this class. Class 7 land may have limitations equivalent to Class 6 land but they do not provide natural sustained grazing by domestic livestock due to climate and resulting unsuitable natural vegetation. Also included are rockland, other nonsoil areas, and small water-bodies not shown on maps. Some unimproved Class 7 land can be improved by draining or diking.

The improved ratings for the property are Class 3 and Class 4.

Land in Class 3 has limitations that are more severe than for Class 2 land and management practises are more difficult to apply and maintain. The limitations may restrict the choice of suitable crops or affect one or more of the following practises: timing and ease of tillage, planting and harvesting, and methods of soil conservation.

note: the information above is an interpretation of the British Columbia Soil Information Finder Tool – B.C. Agricultural Capability Map. An on-site visit of the property has not been conducted.

A soil classification study for the site has been submitted and is attached as an appendix

PLANNING COMMENTS

Background:

The CRD has received an Agricultural Land Commission application for extraction and fill activities on the subject property. The subject property is 56.4 ha (139.4 ac.) in size, with proposed development area of approximately 16.3 ha (40.3 ac.). The property is currently zoned Resource / Agricultural (R/A) in the North Cariboo Area Rural Land Use Bylaw No. 3505, 1999.

The property was previously used for hay production. It was subsequently purchased by the BC Transportation Financing Authority to facilitate the Bastin Hill slide reconstruction and greater Cariboo road recovery projects.

An agricultural soils assessment report was completed by Stantec Engineering Ltd. on behalf of the Ministry of Transportation and Infrastructure (MOTI). The report presents the results of a 2023 pre-development soils assessment, updated soil mapping, and agricultural capability ratings, as well as recommendations for soil conservation and handling during salvage and reclamation activities, weed control, and revegetation at the proposed Pit.

A technical information report was prepared and submitted by Sitkum Consulting Ltd. The report documents material encountered within the testing area and provides recommendations on aggregate suitability, available volumes as well as development, mining and final reclamation procedures.

The proposed pit has been divided into two separate development phases referred to as Phase 1 and 2 in order to maximize the material contained within the pit as well as develop and reclaim the site to current Agricultural Land Commission standards. Development Phase 1 is comprised of the lower terrace, Phase 2 consists of the upper terrace lying to the southwest.

The application specifies a proposed project duration of two years for fill deposit and 50 years for gravel extraction activities.

Location:

The subject property is located at 5302 Bastin Road, approximately 23 km southeast of Quesnel, along the Quesnel-Hydraulic Road. The property is adjacent the Quesnel River, containing steep slopes with a large benchland previously used for hay production and currently proposed for the extraction and fill activities.

CRD Regulations and Policies:

North Cariboo Area Rural Land Use Bylaw No. 3505, 1999

3.5 AGRICULTURAL LANDS

With regards to the agricultural land base, the general policies of the Board are:

(d) to discourage non-farm development of agricultural land unless it can be demonstrated that the lands are not suited for agriculture and that there is no other viable alternative location;

8.14.1 USES PERMITTED

(b) NON-RESIDENTIAL USES:

xx) extraction of raw materials from the land, including crushing and screening activities, but excluding any further processing activities.

Rational for Recommendation:

Planning staff are supportive of the proposed ALR soil and fill use application. The proposed gravel extraction aligns with the current Resource / Agricultural zoning and will support the repair of critical transportation infrastructure within the region. Staff note that Bastin Road is the primary access route for surrounding agricultural properties above the slide location. Further, the applicant has provided a remediation plan to return the gravel extraction area to an agriculturally productive capacity upon completion, and to ensure final grading of the fill area meets ALC policies. Staff note that the pit lifespan is 50 years and will result in long-term, albeit temporary, loss of agricultural land. However, on balance, this application will enable a MOTI-led project which ensures the long-term viability of access to significant agricultural holdings and operations further up Bastin Rd.

Ministry of Agriculture and Food (MAF) were unable to provide a referral response due to limited staff capacity.

At time of drafting, a response from Electoral Area 'C' Advisory Planning Commission is yet to be received. Should the commission be able to meet, their response will be provided at late publishing.

Recommendation:

That the Provincial Agricultural Land Commission application for Soil and Fill Use pertaining to The Fractional South West ¼ of District Lot 9159, Cariboo District, Except Plans BCP28576, EPP21640, EPP21641, and EPP21642 be authorized for submission to the Provincial Agricultural Land Commission with a recommendation for approval.

REFERRAL COMMENTS

Ministry of Agriculture and Food:
No Response

Advisory Planning Commission:
No Response

ATTACHMENTS

Appendix A:	Application
Appendix B:	General Map
Appendix C:	Specific Map
Appendix D:	Orthographic Map
Other:	Applicant Supplied Maps
	Agricultural Soil Assessment
	Technical Information Report

Provincial Agricultural Land Commission - Applicant Submission

Application ID:	100578
Application Type:	Removal of Soil (Extraction) and Placement of Fill within the ALR
Status:	Submitted to L/FNG
Applicant:	BC Transportation Financing Authority
Local/First Nation Government:	Cariboo Regional District

1. Parcel(s) Under Application

Parcel #1

Parcel Type	Fee Simple
Legal Description	THE FRACTIONAL SOUTH WEST 1/4 OF DISTRICT LOT 9159 CARIBOO DISTRICT EXCEPT PLANS BCP28576, EPP21640, EPP21641, AND EPP21642
Approx. Map Area	56.39 ha
PID	013-407-023
Purchase Date	Oct 31, 2022
Farm Classification	Yes
Civic Address	5302 Bastin Road, Quesnel, BC V2J 6R1
Certificate Of Title	Certificate of Title - PID 013407023.pdf

Land Owner(s)	Organization	Phone	Email	Corporate Summary
Steven Lee	BC Transportation Financing Authority	[redacted]	[redacted]	Agent Letter.pdf

2. Other Owned Parcels

Do any of the land owners added previously own or lease other parcels that might inform this application process?	No

3. Primary Contact

Will one of the landowners or government contacts added previously be the primary contact?	No
Type	Third-Party Agent
First Name	Bryan
Last Name	James
Organization (If Applicable)	Sitkum Consulting Ltd.
Phone	[redacted]
Email	[redacted]

4. Government

Local or First Nation Government:	Cariboo Regional District

5. Land Use

Land Use of Parcel(s) under Application

Describe all agriculture that currently takes place on the parcel(s).	Prior to BC Transportation Financing Authority (BCTFA) purchase the property was used for growing hay products as well as a mobile home residence, a work shop and other farming related out buildings. Since the BCTFA purchase there have been no agricultural use of the property.
Describe all agricultural improvements made to the parcel(s).	Irrigation

Describe all other uses that currently take place on the parcel(s).	N/A

Choose and describe neighbouring land uses

	Main Land Use Type	Specific Activity
North	Agricultural / Farm	Bastin Road then farm land
East	Transportation / Utilities	Bastin Road then farm land
South	Other	Forest then the Quesnel River
West	Other	Forest then the Quesnel River

6. Proposal

Has the ALC previously received an application or Notice of Intent for this proposal?	Yes
Application or NOI ID	100056
What is the purpose of the proposal?	Placement of fill from the adjacent Bastin Hill Slide and removal of aggregate for Ministry of Transportation and Infrastructure projects. Fill will be placed at the northern end of the pit area where an unknown quantity of sand and gravel has been removed by the previous land owner. Placement of fill from the Bastin Hill Slide will create an additional area of approximately 1.4 hectares which will be gently sloping (2.0% slope) and will be suitable for agricultural use.
Placement of Fill Project Duration	2 years
Removal of Soil Project Duration	50 years

	Soil to be Removed	Fill to be Placed
Volume	421859 m^3	220000 m^3
Area	100000 m^2	28100 m^2
Maximum Depth	6.15 m	18 m
Average Depth	6.15 m	15 m

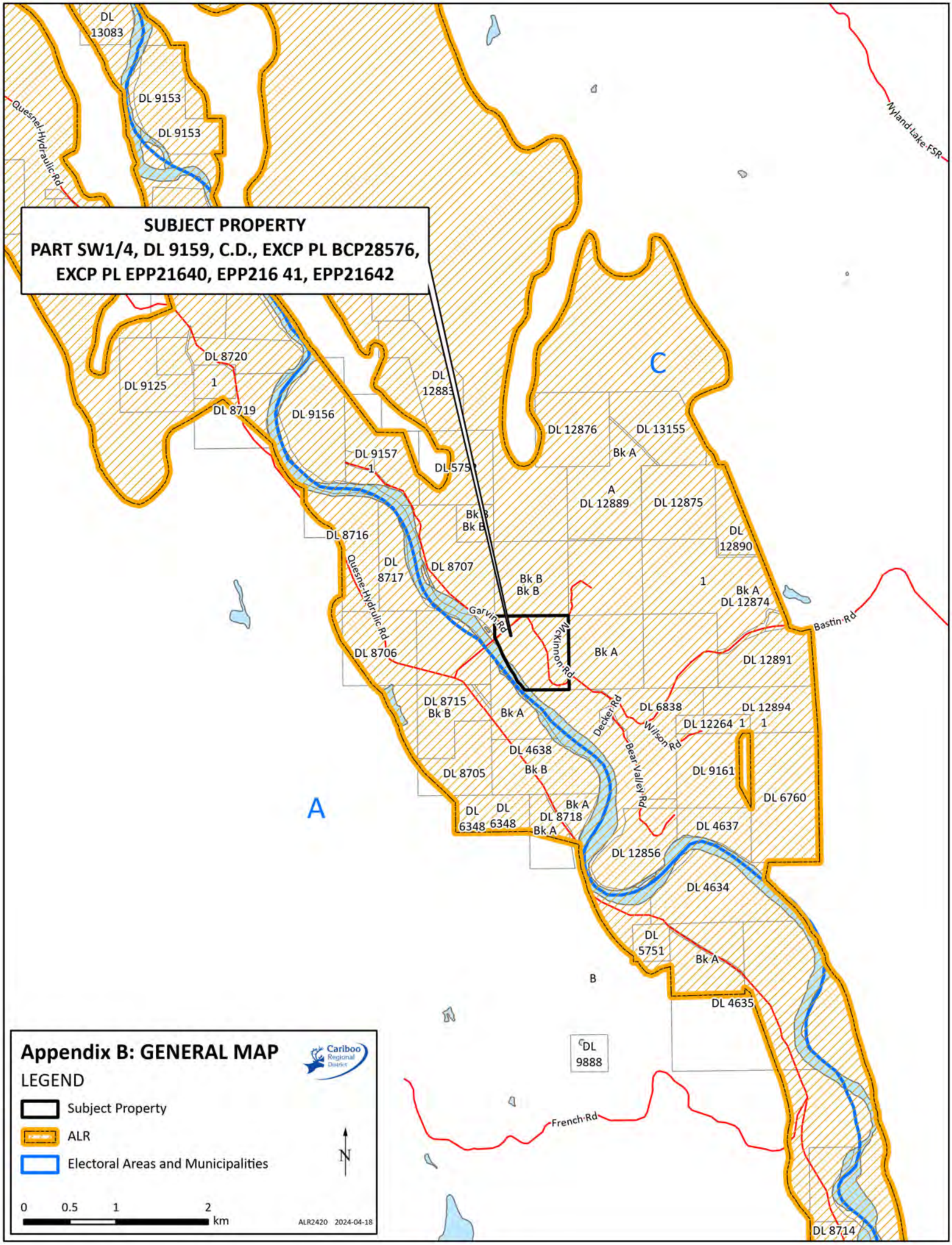
	Soil already Removed	Fill already Placed
Volume	0 m^3	0 m^3
Area	0 m^2	0 m^2
Maximum Depth	0 m	0 m
Average Depth	0 m	0 m

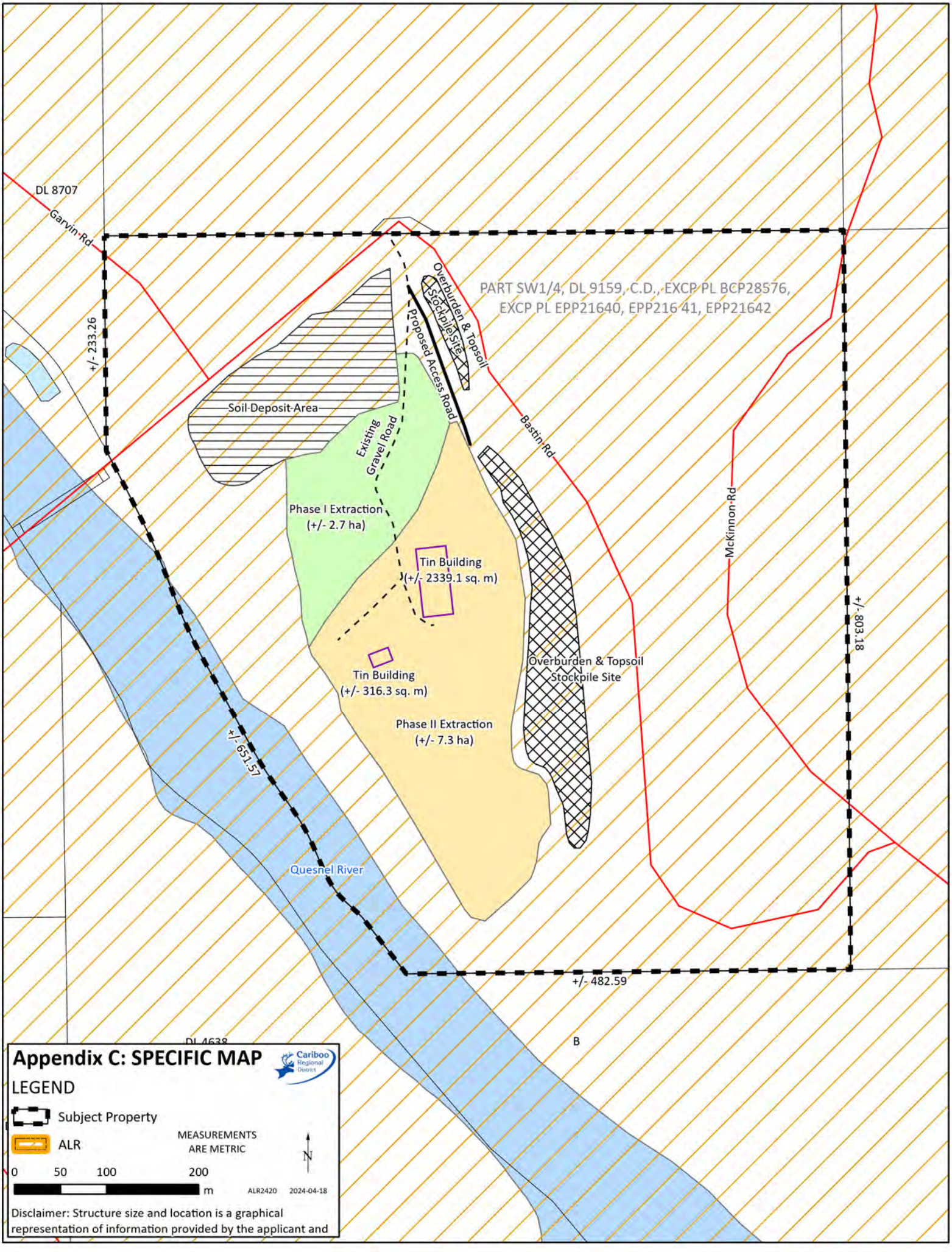
Describe the type, origin and quality of fill proposed to be placed.	The fill material consists of high silt content soils deposited during de-glaciation of the area.
Describe the type of soil proposed to be removed.	Sand and gravel
What alternative measures have you considered or attempted before proposing to place fill?	Alternative waste stockpile areas were considered for this project, but were deemed cost prohibitive due to an increased haul length and associated costs with stockpiling material in those areas. The proximity of this gravel and stockpile pit to the Bastin Hill Project makes for a very compelling case of minimizing haul length, associated GHG emissions and minimizes impacts and improves safety to the overall traffic on the road network.
What steps will be taken to reduce impacts to surrounding agricultural land?	Material will be dumped at the fill site with rock trucks, levelled by a bulldozer and compacted with a 84 inch sheepsfoot roller. Due to the type of fill material no water will be added during the compaction process. At the completion of fill placement the upper surface of the fill will be covered with topsoil. The topsoil will be immediately seeded and fertilized with an appropriate seed and fertilizer mixture. Stripping and stockpiling of topsoil

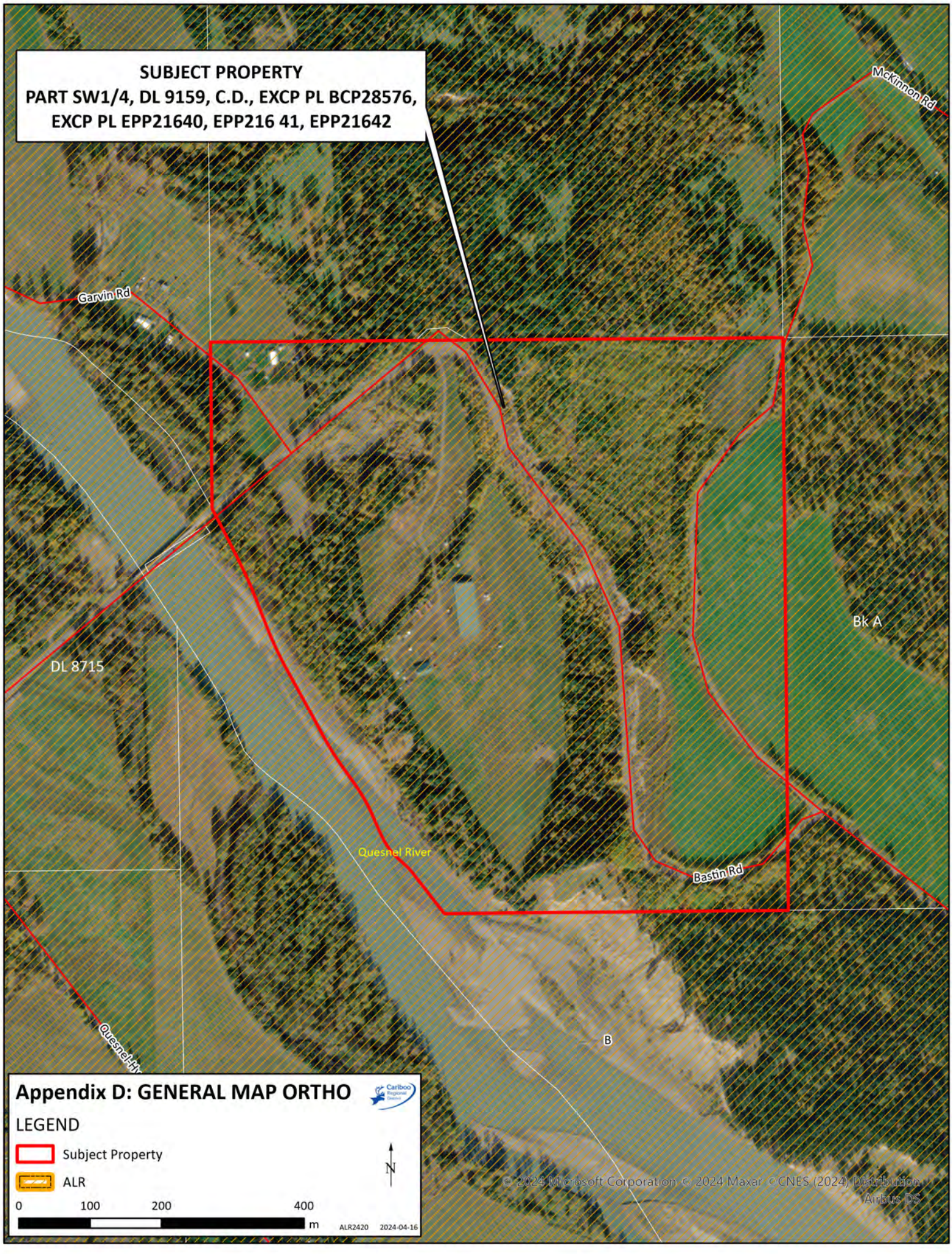
	in the aggregate mining areas will be completed in accordance with the Bastin Pit No, 1471 Agricultural Soils Assessment Report. During aggregate production, stockpiling and hauling the generation of dust will be monitored. If dust becomes and issue spray bars will be installed on aggregate production equipment, working areas, haul roads and stockpile sites will be watered as required.
Proposal Map / Site Plan	Bastin_SiteMap_2024Feb14.pdf
Cross Sections	2024-02-02 Full Stockpile with ORTHO.pdf Bastin_Cross-Sections_A-A1_2024Feb15.pdf Bastin_Cross-Sections_B-B1andC-C1_2024Feb14.pdf 2024-02-02 Bastin Hill Full Stockpile Update.pdf
Reclamation Plan	Bastin_ReclamationMap_2024-02-15.pdf
Is your proposal for aggregate extraction or placer mining?	Yes
Have you submitted a Notice of Work to the Ministry of Energy, Mines and Low Carbon Innovation (EMLI)?	No

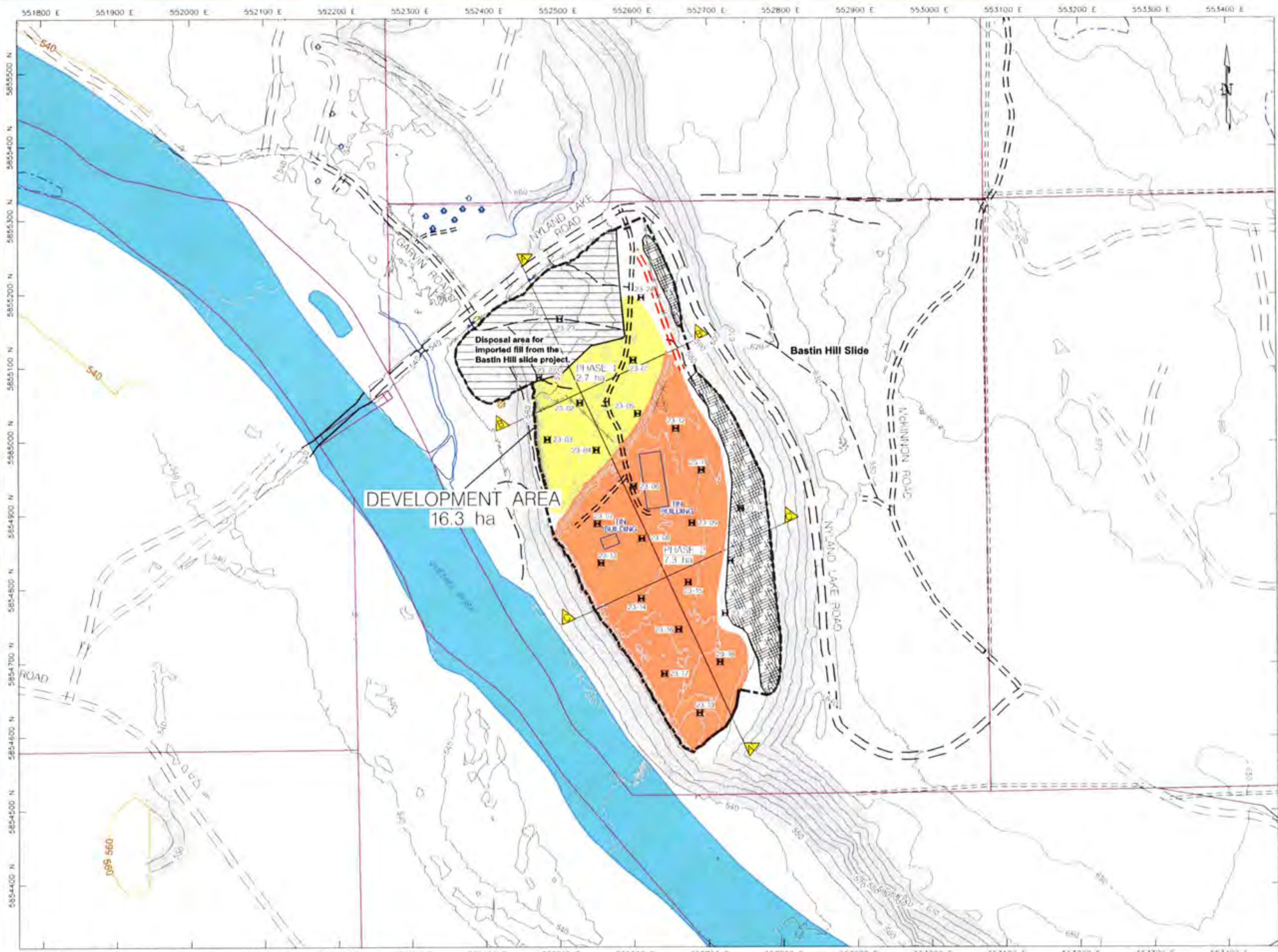
7. Optional Documents

Type	Description	File Name
Other files that are related	Bastin Pit Technical Information Report	Bastin Pit TIR.pdf
Professional Report	Bastin Pit No. 1471 Agricultural Soils Assessment	Agrologists Report.pdf
Other files that are related	Phase 2 Pit Development Plan	Bastin_PDP_Ph2_2024Feb14.pdf
Other files that are related	Phase 1 Pit Development Plan	Bastin_PDP_Ph1_2024Feb14.pdf


SUBJECT PROPERTY
PART SW1/4, DL 9159, C.D., EXCP PL BCP28576,
EXCP PL EPP21640, EPP216 41, EPP21642
DL 13083
DL 9153
DL 9153
Quesnel-Hydraulic Rd
Nyland Lake FSR
DL 8720
1
DL 9125
DL 8719
DL 9156
DL 12883
C
DL 12876
DL 13155
Bk A
DL 9157
1
DL 575
A
DL 12889
DL 12875
Bk B
Bk B
DL 8716
DL 12890
DL 8717
DL 8707
Quesnel-Hydraulic Rd
Bk B
Bk B
1
Bk A
DL 12874
Garvin Rd
McKinnon Rd
Bastin Rd
DL 8706
Bk A
DL 12891
DL 8715
Bk B
Bk A
Decker Rd
DL 6838
DL 12894
1
1
DL 12264
Wilson Rd
DL 4638
Bk B
Bear Valley Rd
DL 9161
DL 8705
DL 6760
A
DL 6348
DL 6348
Bk A
DL 8718
Bk A
DL 4637
DL 12856
DL 4634
DL 5751
Bk A
B
DL 4635
DL 9888
French Rd
DL 8714
Appendix B: GENERAL MAP
LEGEND
Subject Property
ALR
Electoral Areas and Municipalities
Cariboo Regional District
N
0
0.5
1
2
km
ALR2420 2024-04-18


DL 8707
Garvin Rd
+/- 233.26
PART SW1/4, DL 9159, C.D., EXCP PL BCP28576, EXCP PL EPP21640, EPP216 41, EPP21642
Overburden & Topsoil Stockpile Site
Proposed Access Road
Soil Deposit Area
Existing Gravel Road
Bastin Rd
McKinnon Rd
Phase I Extraction (+/- 2.7 ha)
Tin Building (+/- 2339.1 sq. m)
Tin Building (+/- 316.3 sq. m)
Overburden & Topsoil Stockpile Site
Phase II Extraction (+/- 7.3 ha)
+/- 803.18
+/- 651.57
Quesnel River
+/- 482.59
DL 4638
B
Appendix C: SPECIFIC MAP
Cariboo Regional District
LEGEND
Subject Property
ALR
MEASUREMENTS ARE METRIC
N
0 50 100 200
m
ALR2420 2024-04-18
Disclaimer: Structure size and location is a graphical representation of information provided by the applicant and


SUBJECT PROPERTY
PART SW1/4, DL 9159, C.D., EXCP PL BCP28576,
EXCP PL EPP21640, EPP216 41, EPP21642
McKinnon Rd
Garvin Rd
DL 8715
Bk A
Quesnel River
Bastin Rd
B
Quesnel-H
Appendix D: GENERAL MAP ORTHO
LEGEND
Subject Property
ALR
N
0
100
200
400
m
ALR2420
2024-04-16
© 2024 Microsoft Corporation © 2024 Maxar ©CNES (2024) Distribution Airbus DS



LEGEND

- LEGAL LOT BOUNDARY (CADASTRE) / PROPOSED DEVELOPMENT AREA
- ON-SITE BUILDING (LiDAR ORTHO) / POWER POLE (Urban Systems Survey)
- Structure (LiDAR Ortho or Urban Systems Survey / TRIM)
- EXISTING GRAVEL ROAD (LiDAR Ortho / TRIM)
- PROPOSED ACCESS ROAD / CATTLE GUARD (LiDAR ORTHO)
- EXISTING TRAIL (LiDAR Ortho / TRIM)
- BRIDGE / PROPOSED STEEL GATE (APPROXIMATE LOCATION)
- RIVER / LAKE (FTEN)
- STREAM / FENCE (URBAN SYSTEMS SURVEY)
- DEVELOPMENT AREA PHASE 1 / PHASE 2
- NO DISTURBANCE AREA
- 23-01 GPS TEST PIT LOCATION LABEL INDICATES SAMPLE YEAR – PIT #
- CROSS-SECTIONS
- SOIL WASTE AREA
- OVERBURDEN & TOPSOIL STOCKPILE SITE
- CONTOUR: INDEX (10m) / INTERMEDIATE (1m) (LiDAR graded pit, waste pile by Urban Syst.)
- CONTOUR: INDEX (100m) / INTERMEDIATE (20m) (TRIM)

DRAWING NOTES:

1. Base data (1m Contours) provided from LiDAR (received 2023Jan26) graded pit by Sitkum, and waste stockpile design (2024Feb06) by Urban Systems.
2. Cadastre Lines were provided from online sources (Data BC).

PIT DEVELOPMENT NOTES:

1. Pit development must be carried out in accordance with the Health, Safety, and Reclamation Code for Mines in BC, the current Standard Specifications for Highway Construction, and the Aggregate Operations Best Management Practices Handbook for BC and the Stantec Engineering Bastin Pit Agricultural Soils Assessment September 2023 report.
2. Development Phases 1 and 2 require clearing of trees along the western edge as well as stripping and stockpiling of topsoil and overburden prior to mining.
3. Pit excavations must not take place to within a minimum distance of 2m from the edge of clearing & stripped areas.
4. When the contractor discontinues operations in the pit, all working pit faces and stockpiles must be trimmed to 1.5H to 1V slope. Working pit faces must be reshaped with native granular materials. All other permanent slopes must be re-sloped to no steeper than 2H:1V.
5. No dumping of debris or petroleum products is permitted. The pit must be left in a clean and safe condition.

Province of British Columbia
Ministry of Transportation & Infrastructure
GEOTECHNICAL and MATERIALS ENGINEERING

Date	REVISIONS Description	Initial
2023Sep20	Added 2023 Test Pits	KA
2024Feb13	SITE MAP EDITS (incorporate waste stockpile)	FA

DRAWN: KA DATE: JAN 30, 2023 AutoCAD: BASTIN

REVISED: KA DATE: FEB 14, 2024 AutoCAD: K23-108

SCALE 1:5,000 (0 – 125 – 250 METERS)

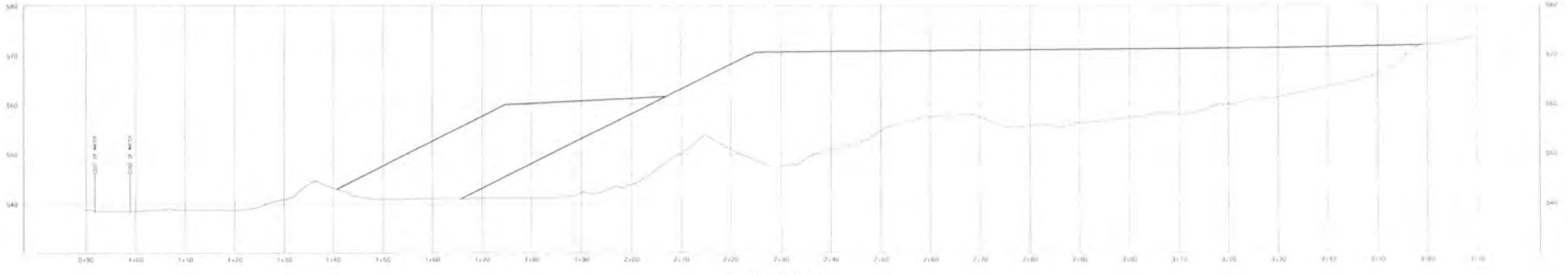
BASTIN PIT #1471
SITE PLAN MAP
FILE NO. Bastin_SiteMap

FIGURE 1

PLAN

BASTIN HILL STOCKPILE
5m RADIUS AROUND WOODPECKER TREES

SECTION A



SECTION B

BASTIN HILL STOCKPILL
5m RADIUS AROUND WOODPECKER TREES

BASTIN PIT
CROSS-SECTION A to A'

MINE PLAN | FIGURE: 5A

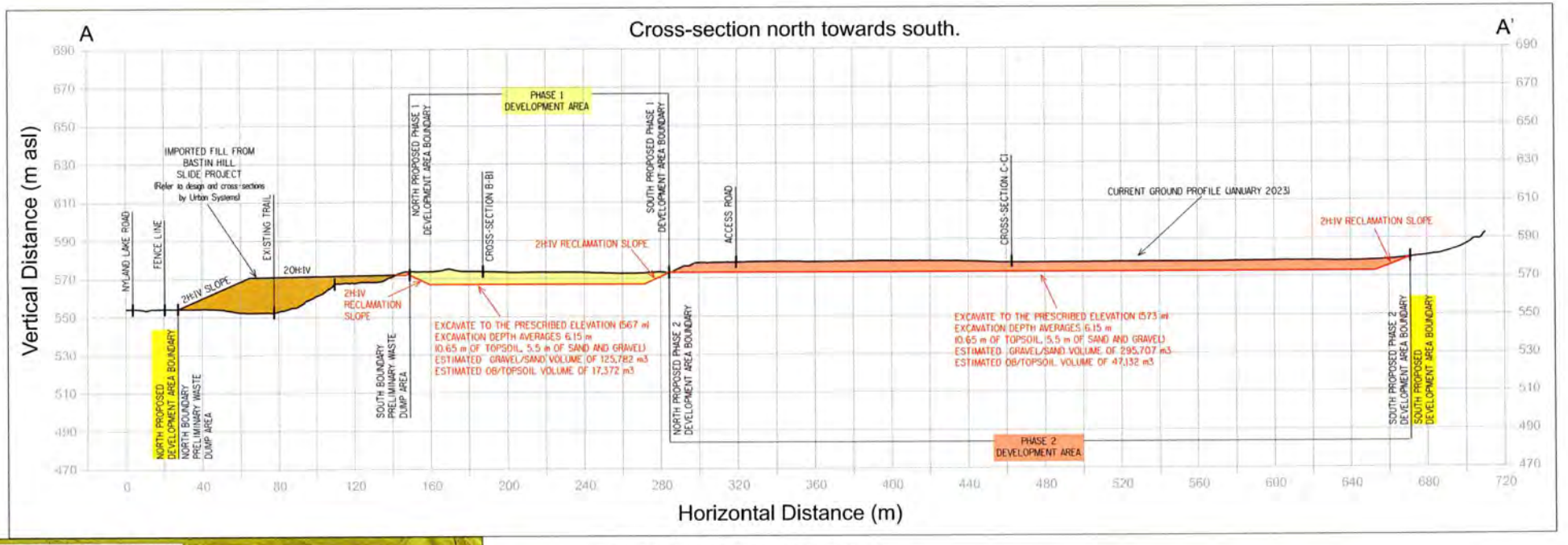
LOCATION: QUESNEL, B.C.
MAPSHEET / OPENING NO: 093B089
UTM ZONE 10 (A-A1, POC): 552451N 5855237E NAD83
PRODUCED FOR: Ministry of Transportation and Infrastructure, South Coast Region, Geotechnical and Materials Branch

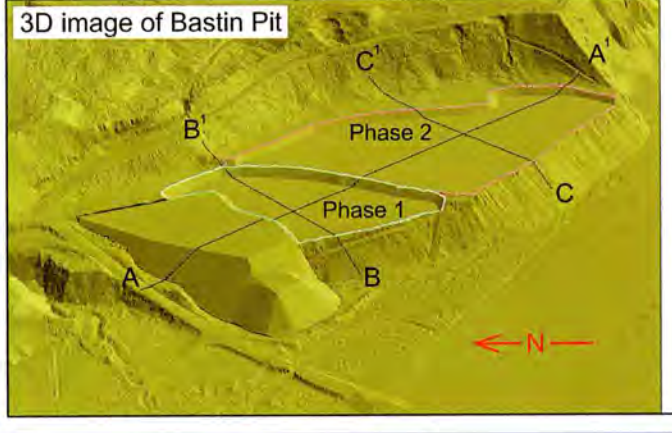
PAGE SIZE: Ansi B 11"x17" | DATE: Feb. 15, 2024
PROJECT: K23-108 | DRAWN: KA
FILENAME: Bastin-Cross-Sections.dgn | CHECKED: BJ
PRODUCED BY: sitkum consulting ltd.

0 100 Metre
CROSS-SECTION SCALE 1:2,000

MAP DATA SOURCE(S):
MoTI - Elevation Data (LiDAR received Jan. 2023)
SCL - Pit Design Features
Urban Systems - Waste Stockpile, Fence lines, Internal Roads
FC1 TRIM & Ortho - Other Features

Refer to PIT DEVELOPMENT NOTES on Cross-section A to A1.





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1. Pit development must be carried out in accordance with the Health, Safety, and Reclamation Code for Mines in BC, the current Standard Specifications for Highway Construction, the Aggregate Operations Best Management Practices Handbook for BC and the Stantec Engineering Bastin Pit Agricultural Soils Assessment September 2023 report.
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4. When the contractor discontinues operations in the pit, all working pit faces and stockpiles must be trimmed to 1.5H to 1V slope. Working pit faces must be reshaped with native granular materials. All other permanent slopes must be re-sloped to no steeper than 2H:1V.
5. No dumping of debris or petroleum products is permitted. The pit must be left in a clean and safe condition.

BASTIN PIT CROSS-SECTIONS B to B^1 & C to C^1

MINE PLAN | FIGURE: 5B

LOCATION: QUESNEL, B.C.
MAPSHEET / OPENING NO: 093B089
UTM ZONE 10 (B-B1, POC): 552432N 5855022E NAD83
UTM ZONE 10 (C-C1, POC): 552521N 5854760E NAD83

PRODUCED FOR:
Ministry of Transportation and Infrastructure
South Coast Region
Geotechnical and Materials Branch

PAGE SIZE: Ansi B 11"x17" | DATE: Feb.13, 2024
PROJECT: K23-108 | DRAWN: KA
FILENAME: Basin-Cross-Sections.dgn | CHECKED: BJ

PRODUCED BY:
sitkum consulting ltd.

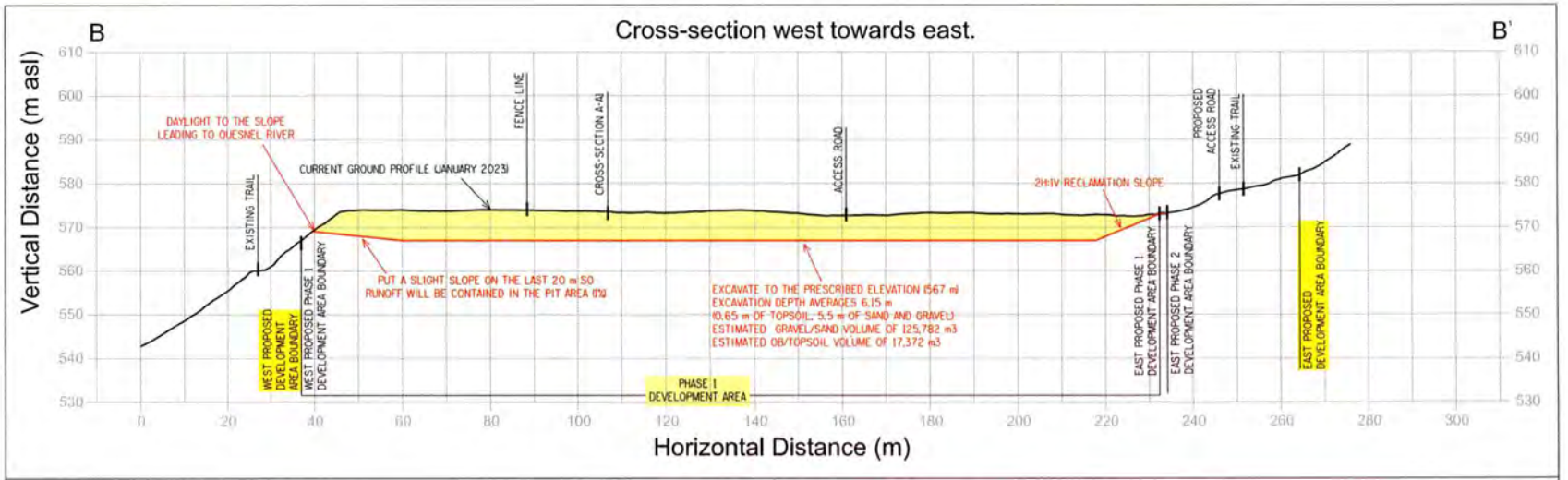
0 50 Metres
CROSS-SECTION SCALE 1:1000

MAP DATA SOURCE(S):

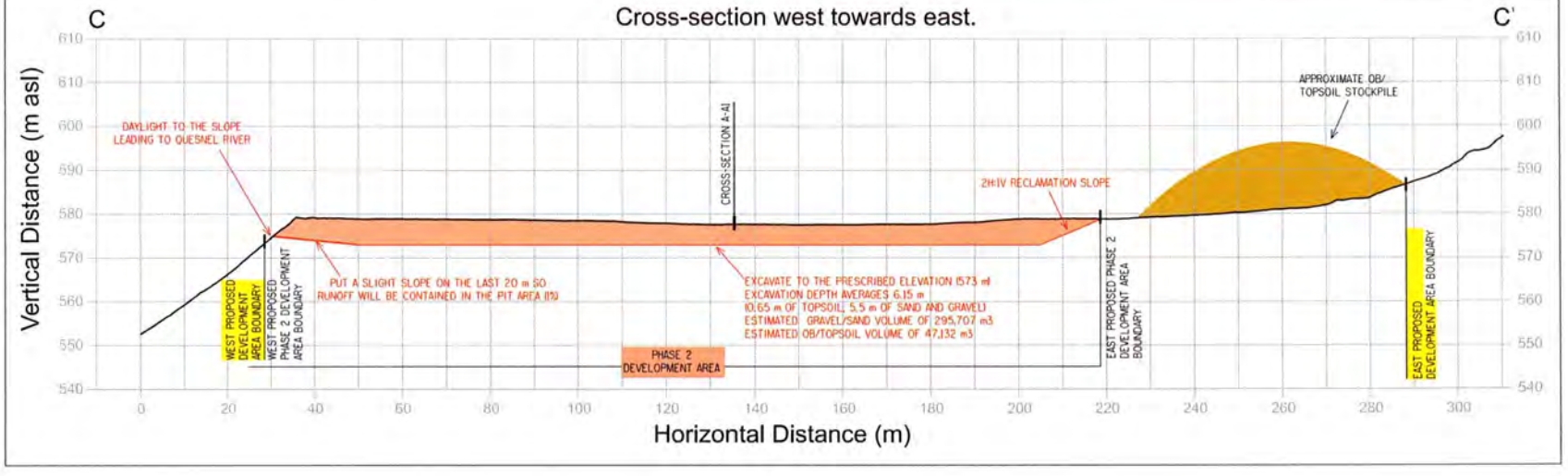
MoTI – Elevation Data (LiDAR received Jan. 2023)
SCL – Pit Design Features
Urban Systems – Waste Stockpile, Fence lines, Internal Roads
FC1 TRIM & Ortho – Other Features

Refer to PIT DEVELOPMENT NOTES on Cross-section A to A1.

Cross-section B to B'



Cross-section C to C'



BASTIN PIT CROSS-SECTIONS B to B^1 & C to C^1

MINE PLAN | FIGURE: 5B

LOCATION: QUESNEL, B.C.
MAPSHEET / OPENING NO: 093B089
UTM ZONE 10 (B-B1, POC): 552432N 5855022E NAD83
UTM ZONE 10 (C-C1, POC): 552521N 5854760E NAD83

PRODUCED FOR:
Ministry of Transportation and Infrastructure
South Coast Region
Geotechnical and Materials Branch

PAGE SIZE: Ansi B 11"x17" | DATE: Feb.13, 2024
PROJECT: K23-108 | DRAWN: KA
FILENAME: Bastin-Cross-Sections.dgn | CHECKED: BJ

PRODUCED BY:
Sitkum consulting ltd.
GEOTECHNICAL SERVICES

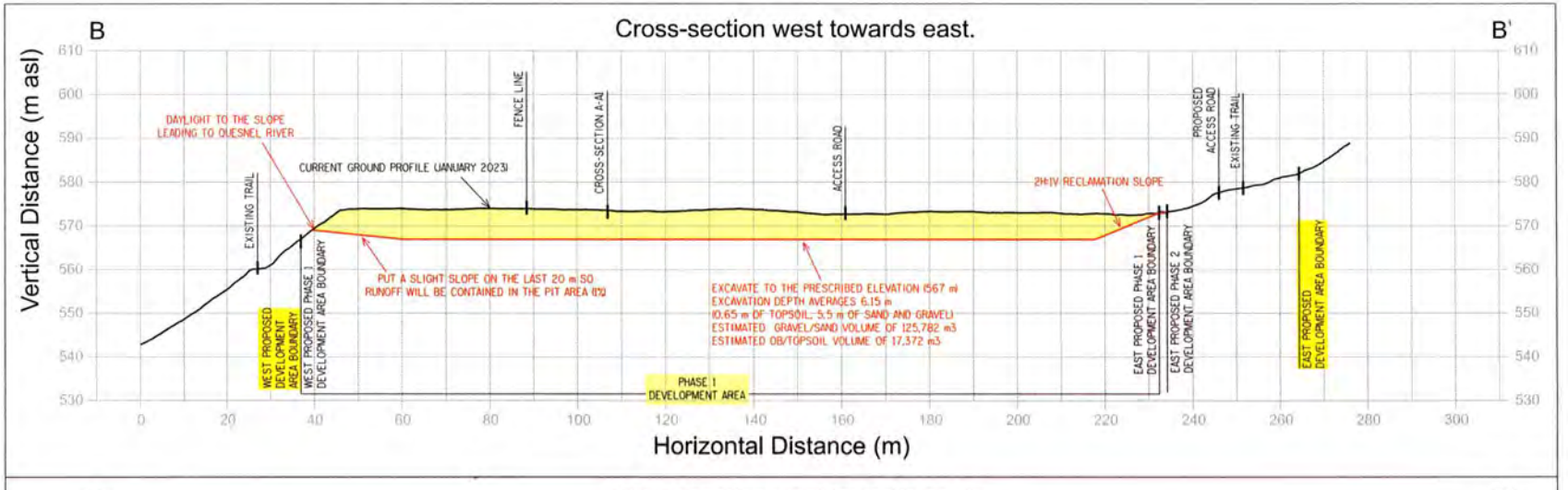
0 50 Metre
CROSS-SECTION SCALE 1:1,000

MAP DATA SOURCE(S):

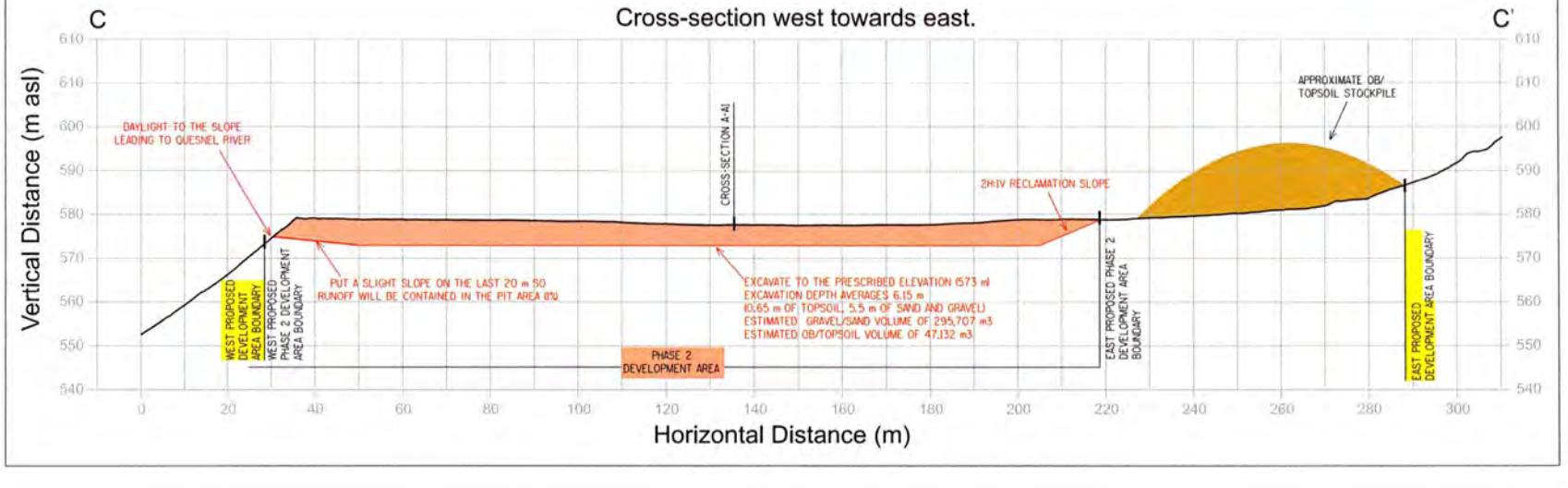
MoTI – Elevation Data (LiDAR received Jan. 2023)
SCL – Pit Design Features
Urban Systems – Waste Stockpile, Fence lines, Internal Roads
FCI TRIM & Ortho – Other Features

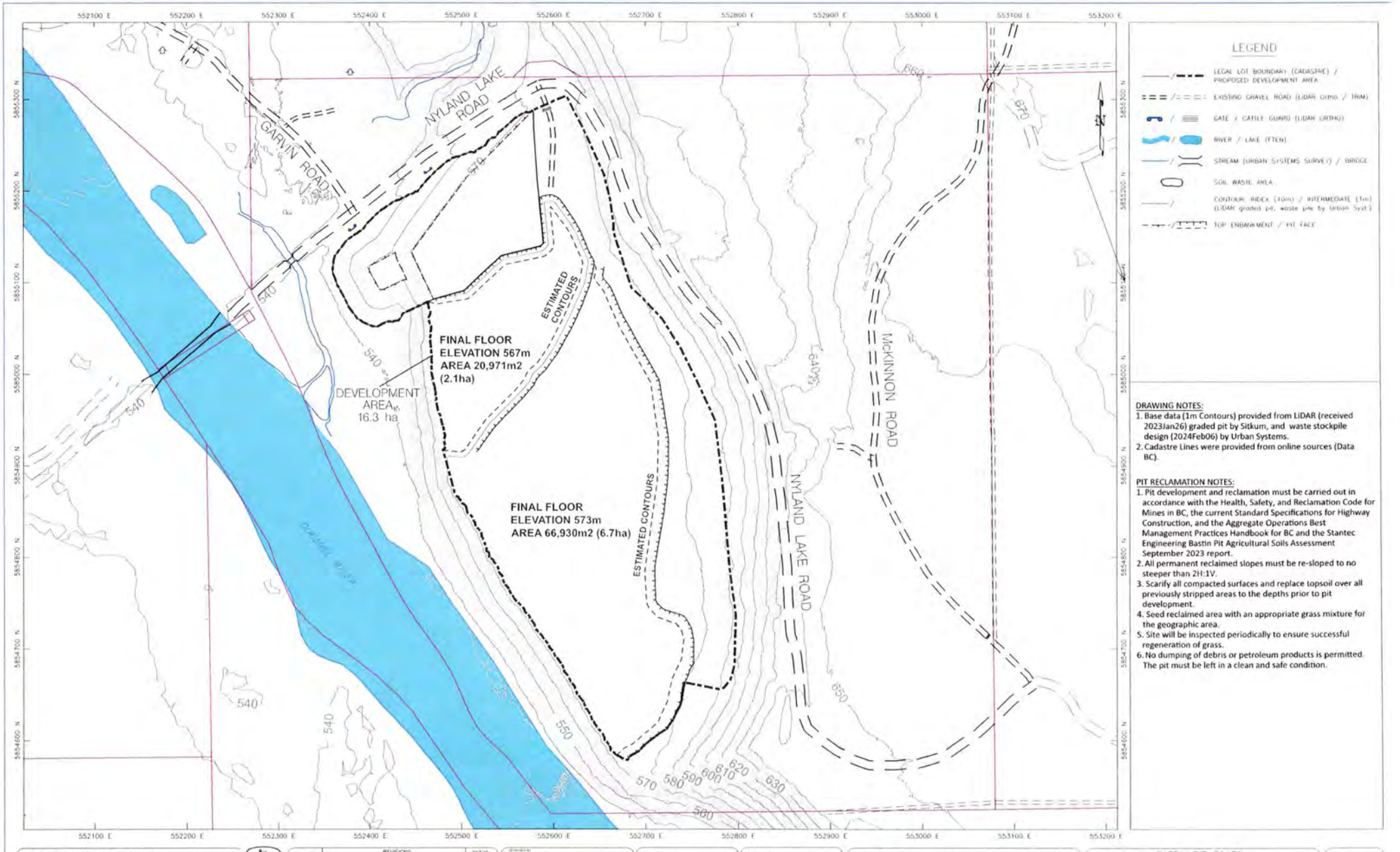
Refer to PIT DEVELOPMENT NOTES on Cross-section A to A1.

Cross-section B to B'



Cross-section C to C'





DRAWING NOTES:

1. Base data (1m Contours) provided from LiDAR (received 2023Jan26) graded pit by Sitkum, and waste stockpile design (2024Feb06) by Urban Systems.
2. Cadastre Lines were provided from online sources (Data BC).

PIT RECLAMATION NOTES:

1. Pit development and reclamation must be carried out in accordance with the Health, Safety, and Reclamation Code for Mines in BC, the current Standard Specifications for Highway Construction, and the Aggregate Operations Best Management Practices Handbook for BC and the Stantec Engineering Bastin Pit Agricultural Soils Assessment September 2023 report.
2. All permanent reclaimed slopes must be re-sloped to no steeper than 2H:1V.
3. Scarify all compacted surfaces and replace topsoil over all previously stripped areas to the depths prior to pit development.
4. Seed reclaimed area with an appropriate grass mixture for the geographic area.
5. Site will be inspected periodically to ensure successful regeneration of grass.
6. No dumping of debris or petroleum products is permitted. The pit must be left in a clean and safe condition.

Province of British Columbia
Ministry of Transportation & Infrastructure
GEOTECHNICAL and MATERIALS ENGINEERING

Date	REVISIONS Description	Initial

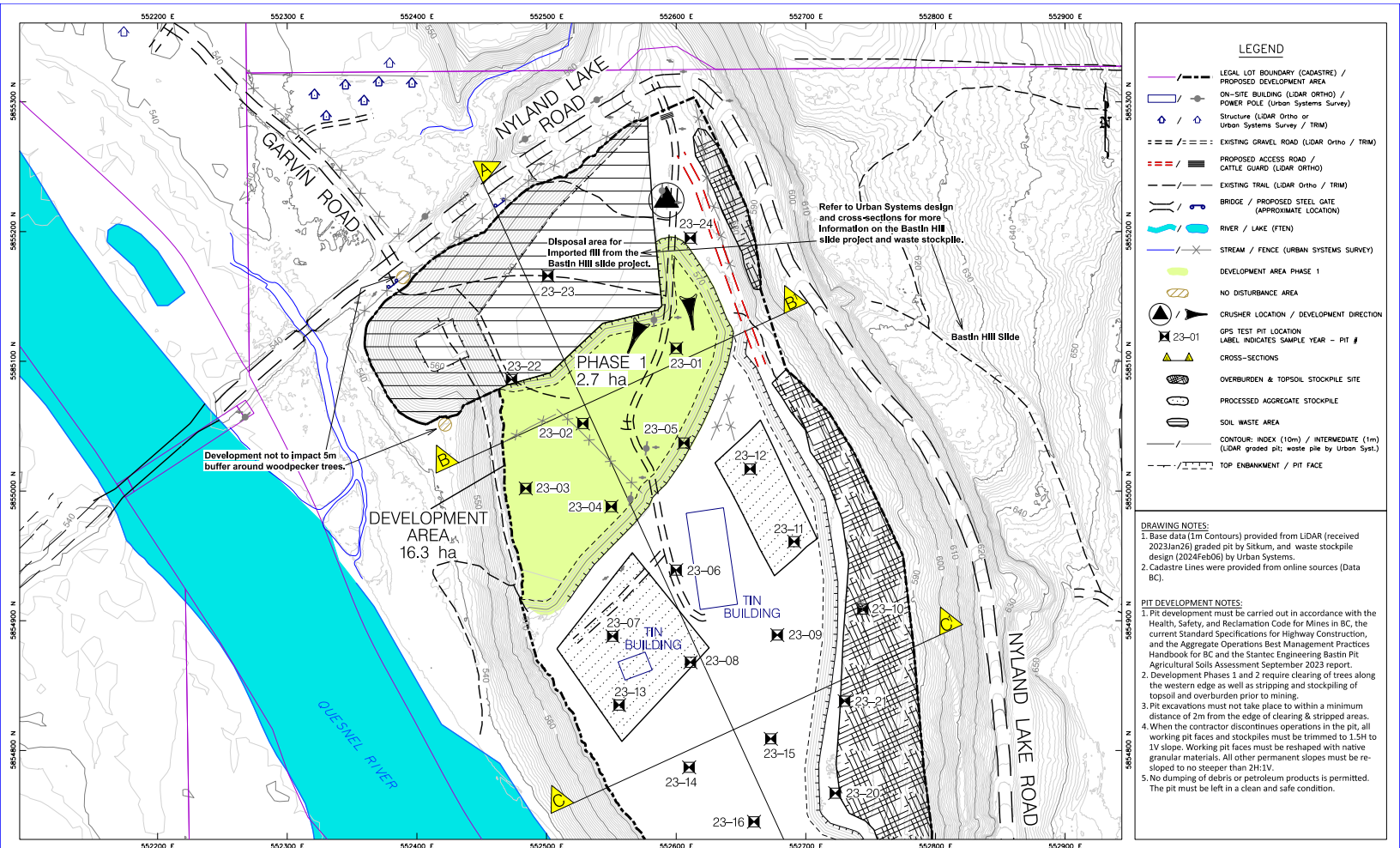
DRAWN: KA
DATE: FEB.15, 2024
AutoCAD: BASTIN

REVISED:
DATE:
AutoCAD: K23-108

0 87.5 175 METERS
SCALE 1:3,500

BASTIN PIT #1471
PIT RECLAMATION PLAN
FILE NO. Bastin_ReclamationMap

FIGURE 4



LEGEND

- LEGAL LOT BOUNDARY (CADASTRE) / PROPOSED DEVELOPMENT AREA
- ON-SITE BUILDING (LIDAR ORTHO) / POWER POLE (Urban Systems Survey)
- Structure (LiDAR Ortho or Urban Systems Survey / TRIM)
- EXISTING GRAVEL ROAD (LiDAR Ortho / TRIM)
- PROPOSED ACCESS ROAD / CATTLE GUARD (LiDAR ORTHO)
- EXISTING TRAIL (LiDAR Ortho / TRIM)
- BRIDGE / PROPOSED STEEL GATE (APPROXIMATE LOCATION)
- RIVER / LAKE (FTEN)
- STREAM / FENCE (URBAN SYSTEMS SURVEY)
- DEVELOPMENT AREA PHASE 1
- NO DISTURBANCE AREA
- CRUSHER LOCATION / DEVELOPMENT DIRECTION
- 23-01 GPS TEST PIT LOCATION LABEL INDICATES SAMPLE YEAR - PIT #
- CROSS-SECTIONS
- OVERBURDEN & TOPSOIL STOCKPILE SITE
- PROCESSED AGGREGATE STOCKPILE
- SOIL WASTE AREA
- CONTOUR: INDEX (10m) / INTERMEDIATE (1m) (LiDAR graded pit; waste pile by Urban Syst.)
- TOP ENBANKMENT / PIT FACE

DRAWING NOTES:

1. Base data (1m Contours) provided from LiDAR (received 2023Jan26) graded pit by Sitkum, and waste stockpile design (2024Feb06) by Urban Systems.
2. Cadastre Lines were provided from online sources (Data BC).

PIT DEVELOPMENT NOTES:

1. Pit development must be carried out in accordance with the Health, Safety, and Reclamation Code for Mines in BC, the current Standard Specifications for Highway Construction, and the Aggregate Operations Best Management Practices Handbook for BC and the Stantec Engineering Bastin Pit Agricultural Soils Assessment September 2023 report.
2. Development Phases 1 and 2 require clearing of trees along the western edge as well as stripping and stockpiling of topsoil and overburden prior to mining.
3. Pit excavations must not take place to within a minimum distance of 2m from the edge of clearing & stripped areas.
4. When the contractor discontinues operations in the pit, all working pit faces and stockpiles must be trimmed to 1.5H to 1V slope. Working pit faces must be reshaped with native granular materials. All other permanent slopes must be re-sloped to no steeper than 2H:1V.
5. No dumping of debris or petroleum products is permitted. The pit must be left in a clean and safe condition.

Province of British Columbia
Ministry of Transportation & Infrastructure
GEOTECHNICAL and MATERIALS ENGINEERING

REVISIONS		
Date	Description	Initial
2023Sept01	Added 2023 Test Pits	KA
2024Feb13	PDP Edits (incorporate waste stockpile design)	KA

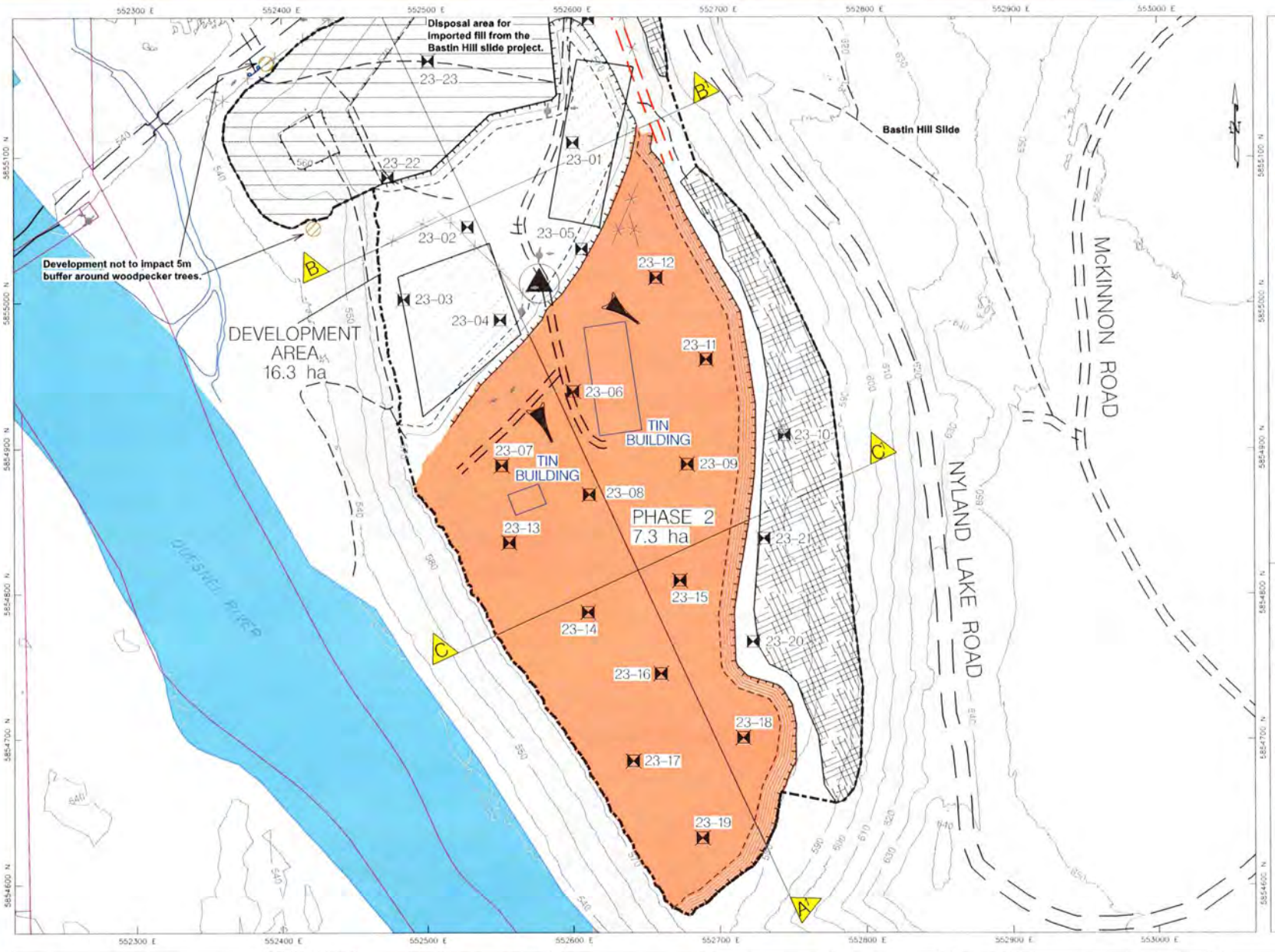
DRAWN: KA
DATE: JAN.30, 2023
AutoCAD: BASTIN

REVISED: KA
DATE: Feb. 14, 2024
AutoCAD: K23-108

0 62.5 125 METERS
SCALE 1:2,500

BASTIN PIT #1471
PIT DEVELOPMENT PLAN-Phase 1
FILE NO. Bastin_PDP_Ph1

FIGURE 2



LEGEND

- LEGAL LOT BOUNDARY (CADASTRE) / PROPOSED DEVELOPMENT AREA
- ON-SITE BUILDING (LiDAR ORTHO) / POWER POLE (Urban Systems Survey)
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- EXISTING GRAVEL ROAD (LiDAR Ortho / TRIM)
- PROPOSED ACCESS ROAD / CATTLE GUARD (LiDAR ORTHO)
- EXISTING TRAIL (LiDAR Ortho / TRIM)
- BRIDGE / PROPOSED STEEL GATE (APPROXIMATE LOCATION)
- 5000 K RIVER / LAKE (FTEN)
- STREAM / FENCE (Urban Systems Survey)
- DEVELOPMENT AREA PHASE 2
- NO DISTURBANCE AREA
- CRUSHER LOCATION / DEVELOPMENT DIRECTION
- 23-01 GPS TEST PIT LOCATION LABEL INDICATES SAMPLE YEAR - PIT #
- CROSS-SECTIONS
- OVERBURDEN & TOPSOIL STOCKPILE SITE
- PROCESSED AGGREGATE STOCKPILE
- SOIL WASTE AREA
- CONTOUR: INDEX (10m) / INTERMEDIATE (1m) (LiDAR graded pit, waste pile by Urban Syst.)
- TOP ENBANKMENT / PIT FACE

DRAWING NOTES:

1. Base data (1m Contours) provided from LiDAR (received 2023Jan26) graded pit by Sitkum, and waste stockpile design (2024Feb06) by Urban Systems.
2. Cadastre Lines were provided from online sources (Data BC).

PIT DEVELOPMENT NOTES:

1. Pit development must be carried out in accordance with the Health, Safety, and Reclamation Code for Mines in BC, the current Standard Specifications for Highway Construction, and the Aggregate Operations Best Management Practices Handbook for BC and the Stantec Engineering Bastin Pit Agricultural Soils Assessment September 2023 report.
2. Development Phases 1 and 2 require clearing of trees along the western edge as well as stripping and stockpiling of topsoil and overburden prior to mining.
3. Pit excavations must not take place to within a minimum distance of 2m from the edge of clearing & stripped areas.
4. When the contractor discontinues operations in the pit, all working pit faces and stockpiles must be trimmed to 1.5H to 1V slope. Working pit faces must be reshaped with native granular materials. All other permanent slopes must be re-sloped to no steeper than 2H:1V.
5. No dumping of debris or petroleum products is permitted. The pit must be left in a clean and safe condition.

Province of British Columbia
Ministry of Transportation & Infrastructure
GEOTECHNICAL and MATERIALS ENGINEERING

Date	REVISIONS Description	Initial
2023Dec07	Added 2023 Test Pits	KA
2024Feb13	PDP Edits Incorporate waste stockpile design	KA

DRAWN: KA
DATE: JAN.30, 2023
AutoCAD: BASTIN

REVISED: KA
DATE: Feb.13, 2024
AutoCAD: K23-108

0 62.5 125 METERS
SCALE 1:2,500

BASTIN PIT #1471
PIT DEVELOPMENT PLAN-Phase 2
FILE NO. Bastin_PDP_Ph2

FIGURE 3

Stantec

Bastin Pit (No. 1471) Agricultural Soils Assessment

September 28, 2023

Prepared for:
Ministry of Transportation & Infrastructure
447 Columbia St.
Kamloops, BC V2C 2T3

Prepared by:
Stantec Consulting Ltd.
500-4515 Central Blvd
Burnaby, BC V5H 0C6

Limitations and Sign-off

This document entitled Bastin Pit (No. 1471) Agricultural Soils Assessment was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Ministry of Transportation & Infrastructure (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by:	_____ Signature	Quality Review by:	_____
	Jonna Jacob, B.Sc., P.Ag. Printed Name		Melvin Zwierink B.Sc, RPF, P.Ag. CPESC Printed Name
Independent Review by:	_____ Signature	Approved by:	_____ Signature
	Kara Hewgill B.Sc., EP Printed Name		Leanne Garand Printed Name

Table of Contents

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Acronyms / Abbreviations

ALC	Agricultural Land Commission
BC	British Columbia
ha	hectares
LFH	Litter fibric humic
m	meters
SMD	Soil moisture deficit
SMU	soil map unit

1 Introduction

The British Columbia (BC) Ministry of Transportation and Infrastructure is proposing to develop the Bastin Pit (No. 1471) (the proposed Pit). The proposed Pit is approximately 25.8 hectares (ha) and is situated in the Caribou Regional District approximately 24 kilometres (km) southeast of Quesnel, BC. The proposed Pit is located within parcel identification 013-407-023 and is entirely within the Agricultural Land Reserve (ALR). A pre-development soils survey assessment (the assessment) including the collection of soil samples was completed within the proposed Pit in May 2023. Soil mapping was updated from the publicly available soil mapping (iMapBC) and the pre-development agricultural capability was determined.

Stantec Consulting Ltd. (Stantec) was retained by the BC Ministry of Transportation and Infrastructure to prepare this agricultural soils assessment (the report) in support of the Ministry's non-farm use application to the Agricultural Land Commission (ALC) for the proposed Pit. This report presents the results of the 2023 pre-development assessment, updated soil mapping, and agricultural capability ratings, as well as recommendations for soil conservation and handling during salvage and reclamation activities, weed control, and revegetation at the proposed Pit.

2 Assessment Area Overview

The assessment area is located on private land within legal land parcel: PART SW1/4, DISTRICT LOT 9159, CARIBOO LAND DISTRICT, EXCEPT PLAN BCP28576, EXC PLANS EPP21640, EPP21641, EPP21642, MANUFACTURED HOME REG.# 100457. The assessment area is within the ALR and is approximately 25.8 hectares.

The topography within the assessment area is generally undulating with strong to very strong slopes towards the perimeter. The current land use is pasture, forested, wetland, and previous disturbance from farm (farmyard, buildings, roads, laydowns) and borrow pit activities.

Soils within the assessment area are primarily Orthic Eutric Brunisols, Orthic Regosols developed on fluvial parent material. Secondary soils include Gleyed Cumulic Regosols developed on fluvial parent material, Brunisolic Gray Luvisols developed on fluvial veneers over glaciolacustrine parent material and Orthic Gray Luvisols developed on glaciolacustrine parent material. The location of the assessment area is presented on Figure 1.

3 Objective

The objective of this report is to provide pre-development site assessment information and recommendations to support soil conservation and reclamation for the proposed Pit within the ALR land.

4 Methods

The pre-development assessment (the assessment) was completed in accordance with the guidelines and format outlined in Policy P-10 Criteria for Agricultural Capability Assessments (ALC 2017).

4.1 Desktop Review

A desktop review was conducted to compile soil baseline information for the proposed Pit and field survey planning. Soil series information from existing BC soil surveys, base map digital files (i.e., topography, watercourses, and imagery) were overlain on the proposed Pit boundaries using ESRI ® ArcPro programs and tools. Data sources reviewed included:

- Existing British Columbia Soil Surveys: Soils of the Quesnel Area, British Columbia. Report No. 31 (Lord, T.M. and Mackintosh, E.E. 1982);
- Spatial files (Google Earth ®, .kmz files, Lidar) and existing agricultural capability mapping accessed from the BC Soil Information Center (Province of British Columbia - iMapBC – Soil Information Finder Tool, Accessed May 2023);
- BC Freshwater Atlas (Accessed May 2023 via iMap BC) to identify watercourses and wetlands associated with the proposed Pit.

4.2 Current Land Use

Current land use includes designation of land use types based on review of the available imagery and data sources during the desktop review followed by field verification of the current conditions of the proposed Pit. Land use was assigned to each soil inspection site during the soils survey (Section 4.3) and applied to the finalized soil map unit during post field work analysis.

4.3 Soil Survey

Soil inspection sites were selected based on preliminary imagery interpretation and considering land use and location of the proposed Pit. In accordance with Policy P-10, the soil inspection sites were also selected based on achieving a soil survey intensity level 1 at a density of one soil inspection site per one to five hectares (Resources Inventory Committee 1995).

Soil inspection sites were accessed by truck and on foot. Soils were excavated and sampled via hand excavation (shovel and Dutch auger). Fourteen (14) soil inspection sites were assessed in the proposed Pit from May 16 to 17, 2023. Detailed inspection sites were dug and augered to a depth of 1.0 m (describe the C horizon) or auger refusal.

Soil mapping was revised from the provincial mapping for comparison between pre-construction and post-construction. Data collected was used to determine agricultural capability ratings. Soil data were collected according to the standards of the Field Manual for Describing Terrestrial Ecosystems (British Columbia Ministry of Environment (BC MOE) and British Columbia Ministry of Forest, Lands Natural Resource Operations and Rural Development (BC MFLRO), previously British Columbia Ministry of Forests and Range (BC MOFR), (BC MOE & BC MOFR 2010)) and the Canadian System of Soil Classification (Soil Classification Working Group [SCWG] 1998).

The GPS location, sample depth and the soil horizon characteristics at soil inspection sites and sample locations were recorded using ESRI ArcGIS Field Maps software. Data collected for each soil inspection site included:

- Slope class, position, length, and gradient
- Aspect
- Surface expression
- Parent material
- Site drainage
- Depth to water table, where observed
- Depth to seepage, where observed
- Land use
- Rooting depth, restricted layer, where observed

Soil profile data collected at each soil inspection site for each soil horizon included:

- Soil horizon depth
- Texture
- Structure
- Consistence
- Colour
- Coarse fragment content
- Carbonates (if present)
- Abundance, size and contrast of mottles and/or gleying (if present)

Photographs of the soil pit and landscape were taken at each soil inspection site (Appendix B).

4.4 Soil Laboratory Analysis

Soil samples were collected to aid and confirm soil characterization and agricultural land capability classification. Samples were collected at two soil inspection sites targeting soil map units and sent to Bureau Veritas Canada Inc. (Bureau Veritas) for soil physical and chemical laboratory analysis. Chemical and physical parameters tested at the Bureau Veritas Laboratory included:

- Available nitrogen, phosphorus, potassium, sulphur (topsoil)
- Total organic carbon (topsoil)
- Texture and texture class by hydrometer
- pH [soluble calcium chloride]
- Electrical conductivity
- Soluble cations (calcium, magnesium, sodium, potassium)
- Soluble anions (chloride, sulphate)
- Sodium Adsorption Ratio
- Saturation percent (%)

4.5 Soil Map Unit

A soil map unit is a defined and named repetitive group of soil bodies occurring together in an individual and characteristic pattern over the soil landscape (Gregorich et al. 2001). Soil map units consist of a dominant soil (series, association or variant) and inclusions (10% to 20% of the soil map unit) of other soils (i.e., series, associations or variants) where warranted.

Soil map unit designation (i.e., soil mapping) was based on the existing mapping in the BC Soil Information Center (Province of British Columbia - BC Soil Information Finder Tool; Lord, T.M. and Mackintosh, E.E. 1982) and was updated based on the May 2023 soil survey field data.

Soil map units were assigned a dominant soil series, topsoil depth, slope classes, and agriculture land capability ratings. Slope classes were assigned to each soil map unit for the purposes of supporting final reclamation contours. Slope classes were assigned based on the class limits used in the Canadian System of Soil Classification (CSSC) (SCWG 1998). Slope classes and related descriptions are provided in Table 4.1.

Table 4.1 Slope Class Descriptions

Slope Class Ranges		
Class	Description	Range of Slope Gradients (%)
1	Level	<0.5
2	Nearly level	>0.5 to 2
3	Very gentle slopes	>2 to 5
4	Gentle slopes	>5 to 10
5	Moderate slopes	>10 to 15
6	Strong slopes	>15 to 30
7	Very strong slopes	>30 to 45
8	Extreme slopes	>45 to 70
9	Steep slopes	>70 to 100
SOURCE: SCWG (1998)		

4.6 Agricultural Land Capability

Field and laboratory data was used to determine agricultural capability ratings. The agricultural capability ratings were assigned to SMUs following the system set out in *Land Capability Classification for Agriculture in British Columbia* (Kenk and Cotic 1983). This system rates agricultural land from Class 1 (the most productive soil) to Class 7 (non-productive land). Table 4.2 has a summary of the Agricultural Capability Class Descriptions. Ratings are based on limitations under specific subclasses specific to the site or area. The subclasses are soil moisture deficiency, adverse (local) climate, soil structure, erosion, excess water, fertility, inundation, salinity, stoniness, topography, shallow bedrock and permafrost (Table 4.3).

Table 4.2 Agricultural Capability Class Descriptions

Class	Description
Class 1	Class 1 land is capable of producing the very widest range of crops. Soil and climate conditions are optimum, resulting in easy management.
Class 2	Class 2 land is capable of producing a wide range of crops. Minor restrictions of soil or climate may reduce capability but pose no major difficulties in management.
Class 3	Class 3 land is capable of producing a fairly wide range of crops under good management practices. Soil and climate limitations are somewhat restrictive.
Class 4	Class 4 land is capable of producing a restricted range of crops. Soil and climate conditions require special management considerations.
Class 5	Class 5 land is capable of producing cultivated perennial forage crops and specially adapted crops. Soil and climate conditions severely limit capability.
Class 6	Class 6 land is important in its natural state as grazing land. These lands cannot be cultivated because of soil or climate limitations.
Class 7	Class 7 land has no capability for soil-bound agriculture.
SOURCE: Adapted from Kenk and Cotic (1983)	

Table 4.3 Agriculture Capability Subclass Descriptions

Subclass	Description
A	Soil moisture deficiency
C	Adverse climate (excluding precipitation)
D	Undesirable soil structure
E	Erosion
F	Low fertility
I	Inundation (e.g., flooding by streams)
N	Salinity
P	Stoniness
R	Shallow soil over bedrock or bedrock outcroppings
T	Topography
W	Excess water (groundwater)
SOURCE: Adapted from Kenk and Cotic (1983)	

5 Results

The results of the soil survey and sampling analysis, and agricultural land capability classification are presented in this section.

The assessment area, land use, soil inspection sites, SMUs, and agricultural capability are shown on Figure 1. Site photos are provided in Appendix A. Detailed soil profile descriptions are provided in Appendix B.1 and soil sample data are presented in Appendix B.2. Chemical and physical laboratory results and certificates of analysis are provided in Appendix C.

5.1 Current Land Use

The current land use of the proposed Pit is pasture, forested, wetland, and previous farm disturbance (e.g., farmyard, buildings, roads, laydowns) and borrow pit activities on private land. The proposed Pit consists of approximately 25.8 ha, including 9.3 ha of pasture, 8.6 ha of forested, and 1.1 ha of wetland. The remaining land use is disturbed to varying degrees and includes 3.2 ha from gravel pit (no topsoil), 1.7 ha from previous disturbance (no topsoil), and 1.9 ha of farmyard (discontinuous topsoil). Photos depicting typical site conditions of each land use of the proposed Pit are provided in Appendix A.

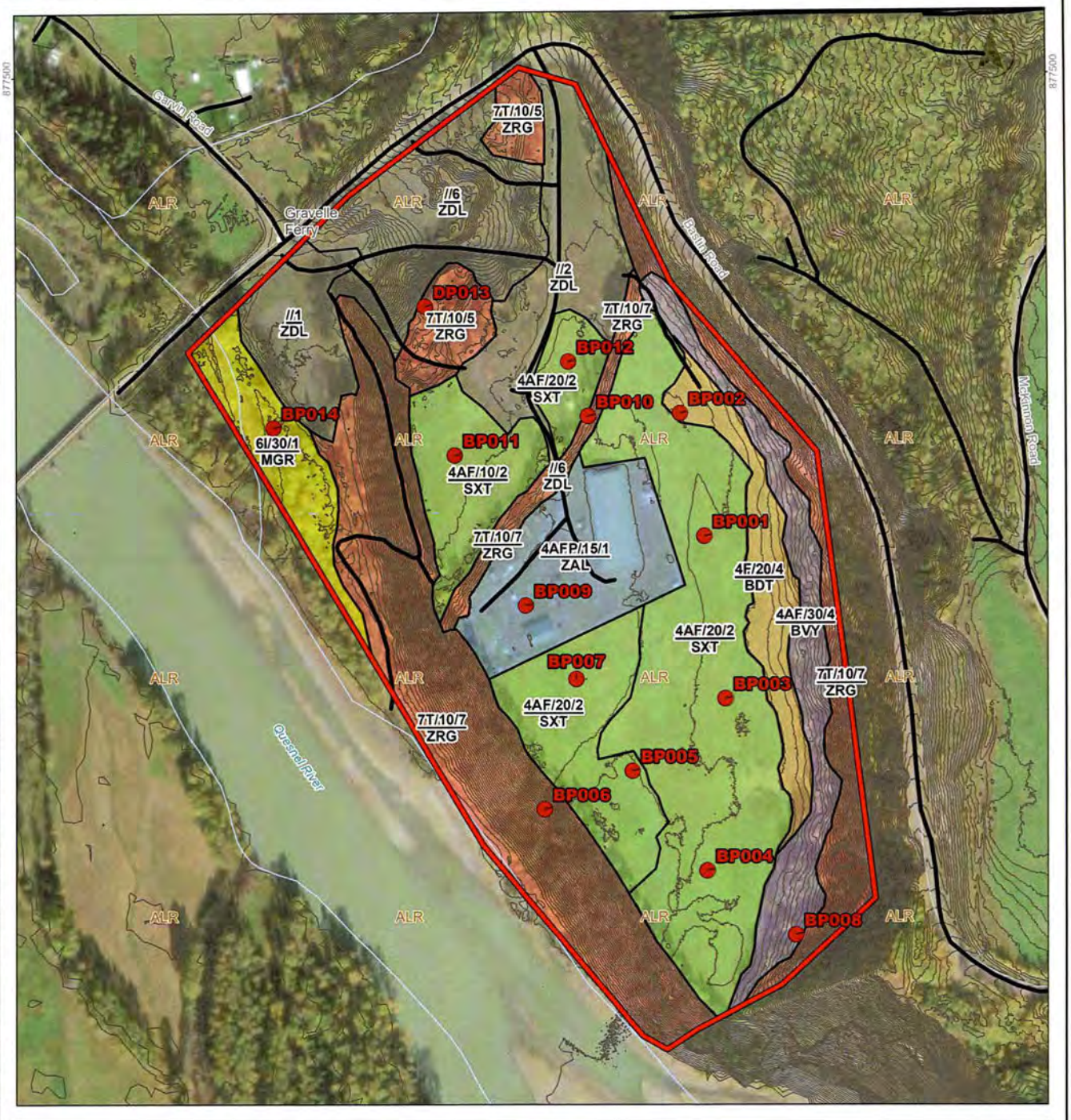
5.2 Soil Survey

Fourteen detailed soil inspection sites were completed during the May 16 - 17, 2023 soil survey. Details of each soil inspection site are summarized in Appendix B. The spatial location of the fourteen inspections is shown in Figure 1.

5.3 Soil Laboratory Analysis

Seven soil samples were collected from two soil inspection sites (BP004 and BP008) within the proposed Pit. Soil inspection site samples collected from site BP004 included the Ap horizon (topsoil), Bm horizon (subsoil), C horizon (parent material). Samples collected from site BP008 included the LFH horizon, Ae horizon (topsoil), Bt horizon (subsoil) and C horizon.

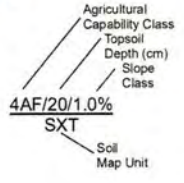
Lab results in combination with the field data are used to support soil classification and determine agricultural land capability. The laboratory results are summarized in Appendix C.



Notes
1. Coordinate System: NAD 1983 BC Environment Albers
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Imagery Source: ESRI World Imageru

Local Street
Road/Trail
Contour (1 m)
Watercourse
Waterbody
Agriculture Land Reserve

Label:



Pit Boundary
Survey Data Locations

Soil Map Unit
- BDT
- BVY
- MGR
- SXT
- ZAL
- ZDL
- ZRG

0 50 100 150 200 m
1:1:4,500 (at original document size of 8.5x11)

Stantec

Project Location:
Gravelle Ferry,
British Columbia

Project Number: 115822030
Prepared by LTRUDELL on 20230607
Requested by BANGELSTAD on 20230607

Client/Project/Report
Ministry of Transportation and Infrastructure

Figure No.
1

Title
Agricultural Capability Mapping
Bastin Hill

DRAFT

\\CA0183-PBAGF01\Workgroup\1232\projects\115822030\figures\reports\Agricultural_Capability_Bastin_Trembley\fig_115822030_Ag_Cap\fig_115822030_Ag_Cap.aprx Revised: 2023-06-16 By: LTrudell

5.4 Soil Map Unit

The dominant soils observed under agricultural use (pasture) within the proposed Pit were categorized as Saxton (SXT), which are dominantly Orthic Eutric Brunisols developed on well-drained fluvial material. Saxton soils were observed to have a poor contrast between the topsoil and subsoil making it difficult to see the colour change between topsoil and upper subsoil. The range of topsoil thickness observed across the site was between 9 centimetres (cm) and 22 cm with the average of depth of 16 cm thickness.

Miscellaneous Regosols (ZRG) were mapped in forested areas on both simple and complex slopes that are strong to very strong. These shallow soils are Orthic Regosols and have thin topsoil with poor colour change between the topsoil and subsoil. Topsoil salvage in this SMU may not be feasible in all areas due to operational constraints of heavy equipment working on strong to very strong slopes.

Beaverley (BVY) soils are Orthic Gray Luvisols developed on moderately well drained glaciolacustrine parent material. The topsoil thickness was observed at 30 cm with a good colour change between the topsoil and subsoil. These soils can be salvaged to the colour change between the topsoil (LFH and A horizon or A horizon) and upper subsoil (B horizion).

Bednesti (BDT) soils are Brunisolic Gray Luvisols that are developed on fluvial veneers over glaciolacustrine parent material. The topsoil thickness was observed at 20 cm with a good colour change between the topsoil and subsoil. These soils can be salvaged to the colour change between the topsoil (LFH and A horizon or A horizon) and upper subsoil (B horizion).

McGregor gleyed (MGRgl) soils are Gleyed Cumulic Regosols developed on imperfect to poorly drained fluvial parent material. Gleyed Cumulic Regosols have buried Ah or O horizons from intermittent flooding and sediment deposition. These soils were mapped in the northwest corner of the proposed pit under wetland landuse. The topsoil salvage thickness is 30 cm.

The remaining soils mapped within the proposed Pit have been previously disturbed. Land surrounding the farmyard has been mapped as abandoned land (ZAL). It was observed that there is intermittent topsoil remaining in some disturbed areas and intact soil in theses disturbed areas have properties of the SXT SMU. Areas with previous disturbance and no topsoil make up the remainder of the SMU and have been mapped as previous disturbance (ZDL). Photographs of soil inspection sites are provided in Appendix A.

Table 5.1 Soil Map Units Summary for the Proposed Pit

Soil Map Unit Symbol	Slope Class	Inspection Sites	Dominant Soil Subgroup	Parent Material	Topsoil Texture	Area* (ha)	Area* (%)
SXT	2	BP001, BP003, BP004, BP005, BP007, BP011, BP012	Orthic Eutric Brunisol	Fluvial	loamy sand – sandy loam	7.1	31.6
ZRG	5-7	BP006, BP010, BP013	Orthic Regosol	Fluvial	loamy sand	6.2	27.4
BVY	4-6	BP008	Orthic Gray Luvisol	Glaciolacustrine	silt loam	1.3	5.8
BDT	4	BP002	Brunisolic Gray Luvisol	Fluvial veneer over Glaciolacustrine	loamy sand	1.0	4.3
MGRgl	1	BP014	Gleyed Cumulic Regosol	Fluvial	fine sandy loam	0.9	4.1
ZAL	1	BP009	N/A	Fluvial	loamy sand	1.7	7.5
ZDL	1, 2, 6	N/A	N/A	N/A	N/A	4.3	19.1
TOTAL						**22.4**	**100.0**
*May not sum due to rounding							

5.5 Agricultural Land Capability

Agricultural land capability ratings were assigned to each SMU within the proposed Pit. SXT and BVY have an unimproved 4AF rating and are limited by soil moisture deficit (A) and fertility (F). These limitations are primarily for the coarse texture (loamy sand) in the upper profile of the soils. At the eastern and western perimeter of the proposed pit, unimproved agricultural land capability is rated 7T for the ZRG SMU due to the presence of strong to very strong slopes (up to 40% slope gradient). BDT have an unimproved rating of 4F and is limited by fertility. MGRgl have a rating of 6I as they are limited by frequent overflow and flooding during the growing season. ZAL have a rating of 4AFP are limited by soil moisture, fertility and coarse fragments.

A summary of agricultural land capability classifications is presented in Table 5. 2. The details of agricultural land capability ratings are based on horizon and site data (Appendix B), and laboratory analytical data (Appendix C).

Table 5.2 Agricultural Land Capability Ratings for SMUs within the Proposed Pit

	SMD		Adverse Climate	Structure		Erosion	Fertility		Inundation		Salinity	Stoniness		Soil Depth	Topography	Excess Water		Permafrost	Final Rating	Final Rating	Area	Area
	U	I		U	I		U	I	U	I		U	I			U	I					
Map Unit	(A)	(A)	(C)	(D)	(D)	(E)	(F)	(F)	(I)	(I)	(N)	(P)	(P)	(R)	(T)	(W)	(W)	(Z)	(U)	(I)	(ha)*	(%)*
BDT	3	1	1	1	1	1	4	1	1	1	1	1	1	1	2	1	1	1	4F	2T	1.0	4.3
BVY	4	1	1	3	3	1	4	1	1	1	1	1	1	1	3	1	1	1	4AF	3DT	1.3	5.8
MGRgl	4	1	1	1	1	1	4	1	6	1	1	1	1	1	1	5	1	1	6I	1	0.9	4.1
SXT	4	1	1	1	1	1	4	1	1	1	1	3	2	1	1	1	1	1	4AF	2P	7.1	31.6
ZAL	4	1	1	1	1	1	4	1	1	1	1	4	3	1	1	1	1	1	4AFP	3P	1.7	7.5
ZRG	4	1	1	1	1	5	4	1	1	1	1	4	3	1	7	1	1	1	7T	7T	6.2	27.4
ZDL	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	4.3	19.1
TOTAL																					**22.4**	**100.0**

NOTES:
U = Unimproved rating
I = Improved Rating
NR = Not rated
*May not sum due to rounding

6 Recommendations For Soil Conservation

The soil handling is based on the soil survey information for the proposed Pit. Table 5.2 presents the soil map units and their associated land capability ratings within the proposed Pit expansion. Topsoil stripping and storage will occur based on the topsoil type and cover soil thickness in the soil map unit and should be verified and approved by a qualified professional during soil handling activities.

The colour change between topsoil and upper subsoil within the BDT and BVY SMU is distinct. These soils should be stripped to colour change. The colour change between topsoil and subsoil within the SXT, MGRgl, ZRG, and ZAL is poor. It is recommended that soils be stripped to the depth presented in Table 6.1 in order to retain the plough layer for agricultural use. The estimated volume of topsoil for the proposed Pit is 16,585 cubic metres (m^3), including an estimated 500 m^3 existing topsoil/subsoil stockpile within the existing disturbed gravel pit and 50% of volume of topsoil remaining with the farmyard.

6.1 Soil Salvage Mitigations

Topsoil will be salvaged, stored onsite, and subsequently replaced separately from subsoil and overburden. Salvaged soil will be stored in designated stockpiles or windrows for replacement during reclamation.

In addition to the methods and strategies detailed above, a variety of best management practices and mitigation measures will be implemented such that soils are handled and stored properly during the salvage phases. Proposed best management practices and mitigations include:

- Plan construction operations to reduce the number of times and distances that salvaged soils are moved.
- Salvage the total thickness of topsoil to a maximum depth as indicated in Table 6.1
- Where there is poor colour separation between topsoil and subsoil, identify subsoil by texture and structure for any site-specific adjustments to depth.
- If topsoil is stripped during frozen conditions, proper equipment (i.e., frozen topsoil cutter, grinder or equivalent) will be used to reduce mixing of topsoil and subsoil in order to maintain the equivalent land capability.
- Topsoil or upper surface material will not be salvaged under extremely windy or rainy conditions.
- Wet conditions will be avoided when possible, during topsoil/overburden material salvage operations.
- Equipment traffic will be controlled during soil salvage to limit admixing, compaction and rutting.
- Equipment traffic will be confined to established routes to avoid unnecessary compaction and rutting of soil in undisturbed areas.
- Soil handling will be suspended if the site becomes so wet or windy that stripping operations are causing severe rutting, compaction, admixing, or wind erosion.

- Remove large stones or cobbles during salvage operation, where practical.

Table 6.1 Soil Handling Description for SMUs

Soil Map Unit	Slope Class	Topsoil/ Subsoil Colour Transition	Estimated Salvage Depth (cm)	Approximate Area of Soil Map Unit (ha)	Estimated Topsoil Volume (m^3)	Soil Handling
SXT	2	Poor – Strip to Depth	10 – 20	7.1	13,164	Salvage depth will be to 10 or 20 cm (target average depth of 15 cm). Salvaged soil will be stored in stockpiles for future reclamation use.
ZRG	5-7	Poor - Strip to Depth	10	6.2	6,153	Salvage depth will be to 10 cm. Overstrip as required to achieve 10 cm salvage depth. Soil salvage may not be operationally feasible on steep slopes. Salvaged soil will be stored in stockpiles for future reclamation use.
BVY	4	Good - Strip to Colour change	30	1.3	3,939	Salvage depth will be to 30 cm. Strip topsoil to colour change between topsoil and subsoil. Salvaged soil will be stored in stockpiles for future reclamation use.
BDT	4	Good - Strip to Colour change	20	1.0	1,941	Salvage depth will be to 20 cm. Strip topsoil to colour change between topsoil and subsoil. Salvaged soil will be stored in stockpiles for future reclamation use.
MGRgl	1	Poor - Strip to Depth	30	0.9	2,786	Salvage depth will be to 30 cm. Strip overlying C horizon with buried Ah or O horizon. Salvaged soil will be stored in stockpiles for future reclamation use.
ZAL	1	Poor - Strip to Depth	15	1.7	1,266	Volume estimate assumes 50% of the farmyard has topsoil remaining and 50% is disturbed with no topsoil.
ZDL	1,2,6	-	-	4.3	500	Estimated 500 m^3 of coversoil stockpiled or windrowed in the existing borrow pit at the north end of the proposed Pit.
Total				**22.4**	**16,585**	
NOTES: Totals may not sum due to rounding						

6.2 Erosion and Sediment Control

Erosion controls will be established to prevent the loss of soil during preparation and use of the proposed Pit. Mitigation to prevent soil erosion will be implemented, as warranted, where soils are cleared of vegetation and left in place, replaced for reclamation, and on soil stockpiles before replacement. With the appropriate mitigation in place, erosion risk is expected to be limited during pit development.

Mitigation measures for erosion and sediment control are as follows:

- Erosion controls will be established to prevent the loss of soil during preparation and use of the proposed Pit.
- Sediment retention measures will be used to reduce the delivery of sediment to surface waterbodies (e.g., Quesnel River).
- Following the salvage of the topsoil, if warranted, stockpiles will be stabilized using either water to reduce wind erosion or a suitable tackifier to reduce wind/water erosion. Topsoil stockpiles will be revegetated as soon as possible.
- Any visible evidence of slope movement, slumping, subsidence, or tension cracks should be repaired immediately.

The effectiveness of the erosion control measures will be monitored, and remedial work will be implemented, where warranted. These remedial measures may include:

- Shutting down soil handling or Pit development at the affected location until the risk of erosion has been reduced or the weather conditions improve.
- Installing sediment fences throughout the proposed Pit and along drainages.
- Installing wind fences.
- Inspecting all temporary sediment control structures on a regular basis and following precipitation events and snowmelt. Make repairs immediately, where warranted.

6.3 Weed Control

Weed occurrences requiring control are defined under the *Weed Control Act*. The publicly available document *Guide to Weeds in British Columbia* (Province of British Columbia 2002a) will be used as a general reference tool to assist in the identification of noxious weeds. Noxious weed management planning for the proposed Pit will incorporate guidelines outlined in the publication: *Seven Steps to Managing Your Weeds* (Province of British Columbia 2002b) and will include inventorying weeds and selecting weed management strategies. Project specific mitigation for weeds include the following measures:

- Clean equipment prior to arriving at the site clean so that it is free of soil or vegetative debris. Equipment should be inspected and deemed to be in appropriate condition before use at the proposed Pit.

- Any equipment which arrives in an unacceptable condition will not be allowed on the site until after it has been cleaned.
- Monitor topsoil piles for weed growth and implement corrective measures (e.g., mowing, hand pulling) to avoid infestation, when warranted.
- Implement manual and/or mechanical weed controls.
- Avoid placing vehicles, equipment, and construction material in areas infested with noxious weeds.
- Restrict the general application of herbicide near sensitive resources. Spot spraying, wicking, mowing, or hand-picking are acceptable measures for weed control in these areas.
- If herbicides are deemed necessary to control the spread of weeds, adhere to the BC *Integrated Pest Management Act* and regulation, with appropriate approvals.

7 Reclamation Planning

The proposed Pit will be restored to the current land use following reclamation of the proposed Pit. The preliminary reclamation plan and mitigations address post development site decommissioning, reclamation, and mitigation to maintain the proposed Pit for agricultural use and to restore the proposed Pit to the equivalent land capability identified in the pre-construction agricultural land rating assessment for this site (Sections 4 and 5). Reclamation will be completed in accordance with the *Reclamation Plans for Aggregate Extraction* ALC Policy P-13 (ALC 2021).

7.1 Subgrade Preparation

The site contours and final grade will maintain similar elevations and site drainage as pre-disturbance. The final contours will allow for equivalent land capability as identified in the pre-disturbance assessment under the topography subclass in Section 5.5. Mitigations for subgrade preparation include:

- If backfill is used during regrading and contouring, it must be of mineral origin and maintain similar soil characteristics (e.g., coarse fragments, texture, salinity, sodicity) within the upper 1 m as pre-disturbance soils.
- Concrete, demolition waste, asphalt, glass, synthetic polymer, treated wood, unchipped lumber may not be used during backfill.
- Final contours of the subgrade must conform to the surrounding landscape.
- Check that surface drainage is consistent with the original natural drainage patterns, directions, and capacity, or is compatible with the surrounding landscape.
- Recontouring is guided by ALC Policy P-13 (ALC 2021) where maximum slopes should not exceed 3.5H:1V (horizontal to vertical); however, recontouring will be dependent on site topography. Agricultural land capability at pre-disturbance conditions is rated as 7T (i.e., no capability for soil bound agriculture due to topography) due to strong to very strong slope gradients (>15% to 45%; SCWG 1998). Increasing slope gradients (i.e., 2H:1V) along the eastern, southern, and western project perimeters, where feasible, will allow for an increase in the area of more level terrain that is better suited for agriculture use. Access to this more level terrain on the recountoured land can be established from the north.
- If compaction occurs during backfilling, grading and contouring the subgrade should be plowed/ ripped to a minimum depth of 60 cm in two directions at right angles to alleviate compaction.
- If soils are moist, postpone plowing/ ripping subsoils until soils dry to prevent soil fracture when plowed/ ripped.

7.2 Soil Replacement

Soil replacement at the proposed Pit will occur following the completion of borrow pit extraction. After the proposed Pit is no longer required it will be decommissioned and reclaimed. Soil will be replaced on the proposed Pit implementing the following mitigations:

- Topsoil should be spread uniformly to maintain equivalent pre-disturbance depths.
- Postpone replacement of topsoil during wet conditions to prevent erosion or damage to the soil structure.
- Re-grade areas with vehicle ruts or erosion gullies.
- Re-grade areas of rutted mineral subsoil/subgrade before topsoil is replaced.
- Smooth and level the ripped subsoil/subgrade surface to prevent admixing of subsoil/subgrade and topsoil when the topsoil or subsoil material is replaced.
- Replace salvaged soil (i.e., topsoil/subsoil) to pre-construction contours, where practical, and to uniform depth.
- Delay topsoil replacement until soils are not frozen.
- In areas where the topsoil or subsoil is in place and compaction is believed to be an issue then, use special equipment, such as a para-tiller, to relieve compaction with reduced potential for admixing.

7.3 Revegetation

The seedbed should be prepared following topsoil replacement and seeded with an appropriate agronomic/ pasture seed mix. Cover crops should be included in the seeding on slopes to reduce erosion and fertilizer should be applied at the time of seeding. The application rate, type of seed mix and fertilizer should be determined by a qualified professional in consultation with the landowner. If areas are returning to forested land use, natural recovery is the preferred method of reclamation. Additionally, the following measures for revegetation should be applied.

- Seed as close as practical after topsoil replacement and seedbed preparation, pending seasonal and weather conditions.
- Till the seedbed just prior to seeding to limit the time in which the soil surface will be exposed to water and wind.
- Till under moist soil conditions; not excessively wet or powdery dry.
- Use suitable equipment for seedbed preparation based on soil conditions.
- Till soil perpendicular to the slopes to reduce the runoff velocity and potential for erosion
- Acquire certificates of analysis for all seed mixes
- Apply seed using a rangeland drill or equivalent. Use broadcast application on steep terrain, fence lines, road ditches, and where deemed the preferred method.
- Restrict vehicle assess over newly seeded areas.
- Fertilizer rates will be based on soil testing following soil replacement.
- Seed mixes must not increase the frequency or distribution of weed species on the proposed Pit or surrounding ground.
- Weed control may include reseeding, tilling, mowing, mulching, or herbicide application.

8 Monitoring and Closure

Following reclamation and revegetation, the establishment of vegetation cover will be inspected until equivalent land capability is confirmed, and appropriate conditions specified in the ALC authorization are met. Remedial actions (e.g., reseeding, decompaction and regrading) will be undertaken as deemed required by a qualified professional through these inspections.

A closure report will be submitted to the ALC upon completion of reclamation and revegetation to confirm agricultural capability has been restored. The report will be completed by a qualified professional after the second full growing season. Specific requirements of the closure report will be outline in the conditions of the ALC authorization.

9 References

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Appendices

Appendix A Photographs

Photo A.1 **Site BP001 - View South**

Photo A.2 **Site BP001 – Pit – Saxton SMU: Orthic Sombric Brunisol with 15 cm topsoil (Ap) depth**

Photo A.3 **Site BP002 – View South**

Photo A.4 **Site BP002 – Pit – Bednesti SMU: Brunisolic Gray Luvisol with 15 cm topsoil (Ap) depth**

Photo A.5 **Site BP003 – View West**

Photo A.6 **Site BP003 – Pit – Saxton SMU: Orthic Eutric Brunisol with 11 cm topsoil (Ap) depth**

Photo A.7 **Site BP004 – View North**

Photo A.8 **Site BP004 – Pit – Saxton SMU Orthic Eutric Brunisol with 15 cm topsoil (Ap) depth**

Photo A.9 **Site BP005 – View North**

Photo A.10 **Site BP005 – Pit – Saxton SMU Orthic Eutric Brunisol with 22 cm topsoil (Ap) depth**

Photo A.11 Site BP006 – View West

Photo A.12 Site BP006 – Pit – Misc. Regosol Orthic Regosol

Photo A.13 **Site BP007 – View East**

Photo A.14 **Site BP007 – Pit – Saxton SMU Orthic Eutric Brunisol with 22 cm topsoil (Ap) depth**

Photo A.15 **Site BP008 – View West**

Photo A.16 **Site BP008 – Pit – Beaverley Orthic Gray Luvisol with 30 cm topsoil (LFH +Ae) depth**

Photo A.17 **Site BP009 – View North**

Photo A.18 **Site BP009 – Pit - ZAL SMU with 15 cm topsoil (Ap) depth**

Photo A.19 Site BP010 – View South

Photo A.20 Site BP010 – Pit – ZRG SMU Orthic Regosol

Photo A.21 **Site BP011 – View North**

Photo A.22 **Site BP011 – Pit – Saxton SMU Orthic Eutric Brunisol with 9 cm topsoil (Ap) depth**

Photo A.23 **Site BP012 – View North**

Photo A.24 **Site BP012 – Pit – Saxton SMU Orthic Eutric Brunisol with 20 cm topsoil (ABp) depth**

Photo A.25 **Site BP013 - View South**

Photo A.26 **Site BP013 – Pit – ZRG SMU Orthic Regosol**

Photo A.27 **Site BP014 – View East**

Photo A.28 **Site BP014 – Pit – McGregor gleyed SMU – Gleyed Cumulic Regosol with 30 cm salvage depth**

Appendix B Soil Profile and Sample Sites Information

B.1 Soil Profile Descriptions

Site Number	Horizon	Depths (cm)	Texture	Structure	Consistence	Colour	Mottles	Coarse Fragments (% vol)	Drainage	Effective Rooting Depth (cm)
BP001	Ap	0 - 15	LS	W/ F/GR	Very Friable/Moist	10YR/ 3/2	-	5/ Coarse gravel		
	Bm	15 - 33	LS	Single Grain	Very Friable/Moist	2.5Y/ 4/3	-	20/ Cobble /Gravel		
	C	33 - 100	S	Single Grain	Loose/Moist	10YR/ 3/4	-	20/ Gravel	Well	30
BP002	Ap	0 - 15	LS	W/ F/GR	Very Friable/Moist	10YR/ 3/2	-	1/ Gravel		
	Bm	15 - 48	LCoS	W/ M/PL	Very Friable/Moist	2.5Y/ 4/3	-	1/ Gravel		
	Btj	48 - 69	SiL	W/ M/SBK	Friable/Moist	2.5Y/ 4/2	-	-		
	BC	69 - 90	SiC	M/ M/MA	Friable/Moist	10YR/ 4/4	-	-		
	IIC	90 - 100	LS	Single Grain	Loose/Moist	2.5YR/ 4/2	-	20/ Gravel	Well	30
BP003	Ap	0 - 11	LS	W/ F/GR	Very Friable/Moist	10YR/ 3/3	-	10/ Gravel		
	Bm	11 - 35	LS	Single Grain	Very Friable/Moist	10YR/ 4/4	-	35/ Gravel/Cobble		
	C	35 - 40	CoS	Single Grain	Loose/Moist	10YR/ 4/2	-	40/ Coarse gravel /Fine gravel	Well	25
BP004	Ap	0 - 15	SL	W/ F/GR	Very Friable/Moist	10YR/ 3/2	-	2/ Gravel		
	Bm	15 - 31	L	W/ M/PL	Very Friable/Moist	10YR/ 4/4	-	2/ Gravel		
	C	31 - 70	SL	Single Grain	Loose/Moist	10YR/ 4/3	-	2/ Gravel		
	C2	70 - 75	S	Single Grain	Loose/Moist	10YR/ 4/2	-	40/ Gravel	Well	30
BP005	Ap	0 - 22	LFS	W/ F/GR	Very Friable/Moist	10YR/ 3/3	-	5/ Coarse gravel		
	Bm	22 - 48	FS	W/ M/SBK	Friable/Moist	10YR/ 4/3	-	10/ Gravel		
	C	48 - 100	S	Single Grain	Loose/Moist	2.5YR/ 4/3	-	5/ Gravel	Well	25

Site Number	Horizon	Depths (cm)	Texture	Structure	Consistence	Colour	Mottles	Coarse Fragments (% vol)	Drainage	Effective Rooting Depth (cm)
BP006	LF	3 - 0	-	-	-	-	-	-		
	C	0 - 100	LS	/ F/GR	Very Friable/Moist	10YR/ 4/4	-	20/ Gravel/Cobble	Well	35
BP007	Ap	0 - 20	LS	W/ M/GR	Very Friable/Moist	10YR/ 3/3	-	10/ Gravel/Cobble		
	Bm	20 - 35	LS	W/ F/SBK	Very Friable/Moist	7.5YR/ 3/3	-	10/ Gravel		
	C	35 - 65	S	Single Grain	Loose/Moist	7.5YR/ 4/3	-	30/ Gravel	Well	30
BP008	LFH	7 - 0	-	-	-	-	-	-		
	Ae	0 - 23	SiL	W/ M/PL	Friable/Moist	10YR/ 4/3	-	2/ Gravel		
	Bt	23 - 58	SiC	M/ F/SBK	Firm/Moist	10YR/ 4/2	-	2/ Gravel		
	C	58 - 100	SiL	/ F/MA	Firm/Moist	2.5Y/ 4/3	-	10/ Gravel	Moderately Well	25
BP009	Ap	0 - 14	LS	W/ F/GR	Very Friable/Moist	7.5YR/ 3/2	-	10/ Medium gravel		
	Bm	14 - 32	S	Single Grain	Loose/Moist	7.5YR/ 4/4	-	10/ Fine gravel		
	C	32 - 50	S	Single Grain	Loose/Moist	2.5Y/ 3/4	-	50/ Fine gravel	Well	25
BP010	Bm	0 - 2	LS	Single Grain	Loose/Moist	10YR/ 3/3	-	20/ Coarse gravel		
	C	2 - 40	CoS	Single Grain	Loose/Moist	2.5Y/ 4/3	-	40/ Coarse gravel /Fine gravel	Well	20
BP011	Ap	0 - 9	LS	W/ F/GR	Very Friable/Moist	10YR/ 3/3	-	2/ Coarse gravel		
	Bm	9 - 30	LS	Single Grain	Very Friable/Moist	7.5YR/ 4/4	-	10/ Medium gravel		
	C	30 - 40	CoS	Single Grain	Loose/Moist	7.5YR/ 3/2	-	60/ Fine gravel	Well	25

Site Number	Horizon	Depths (cm)	Texture	Structure	Consistence	Colour	Mottles	Coarse Fragments (% vol)	Drainage	Effective Rooting Depth (cm)
BP012	ABp	0 - 20	LS	Single Grain	Very Friable/Moist	10YR/ 4/2	-	20/ Gravel/Cobble		
	C	20 - 60	LFS	Single Grain	Very Friable/Moist	10YR/ 4/2	-	20/ Gravel	Well	25
BP013	L	1 - 0	-	-	-	-	-	-		
	C	0 - 50	LS	Single Grain	Very Friable/Moist	2.5YR/ 3/3	-	30/ Coarse gravel	Well	25
BP014	Cg	0 - 8	FSL	/ M/MA	Slightly Sticky/Wet	GLEY1/ 5/10Y	F/F/F	-		
	Omb	8 - 19	-	-	-	-	-	-		
	Cg	19 - 100	VFSL	/ M/MA	Slightly Sticky/Wet	GLEY1/ 5/10Y	C/M/D	-	Poor	35

Notes:

Texture:
LS – loamy sand
S – sand
LCoS – loamy coarse sand
SiL – silt loam
SiC – silty clay
CoS – coarse sand
LFS – loamy fine sand
FS – fine sand
LVFS – loamy very fine sand

Structure:
Grade:
W – weak
M – moderate

Class:
F – fine
M – medium

Kind:
GR – granular
PL – platy
SBK – subangular blocky
MA - massive

Mottles:
Abundance:
F – fine
C - common

Size:
F – fine
M - medium

Contrast:
F – faint
D - distinct

B.2 Soil Descriptions

B.2.1 Saxton

Extent (ha/ %)	SXT: 7.1 ha / 31.6%
Soil Classification	Orthic Eutric Brunisol
Parent Material	Fluvial
Dominant Texture (topsoil / subsoil)[1]	sandy loam - loamy sand / loam - sand
Slope Class / Percent Slope Range	2 / 2 to 4%
Drainage Class Range	Well
Topsoil Depth	9 to 23 cm
Land Use	Pasture
Dominant Colour Transition (topsoil / subsoil) (distinct / indistinct)[1]	Very dark grayish brown, dark grayish brown / dark yellowish brown, brown (indistinct)

PROFILE SITE: BP004 (SXT)[1]

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence
Ap	0-15	Very dark grayish brown	Sandy loam	Granular	Very friable
Bm	15-31	Dark yellowish brown	Loam	Subangular blocky	Very friable
C	31-70	Brown	Sandy loam	Single Grain	Loose
C2	70-75	Dark grayish brown	Sand	Single Grain	Loose

Notes:

[1] Based on characteristics of individual soil inspections of the described soil series, rather than all soil inspections that occur within the mapped soil unit.

B.2.2 Misc. Regosol

Extent (ha/ %)	ZRG: 6.2 ha / 27.4%
Soil Classification	Orthic Regosol
Parent Material	Fluvial
Dominant Texture (topsoil / subsoil)[1]	Loamy sand
Slope Class / Percent Slope Range	7 / 32 to 40%
Drainage Class Range	Well
Topsoil Depth	10 cm overstrip
Land Use	Forested
Dominant Colour Transition (topsoil / subsoil) (distinct / indistinct)[1]	Dark brown, brown (indistinct)

PROFILE SITE: BP006 (ZRG)[1]

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence
LF	3-0	-	-	-	-
C	0-100	Brown	Loamy sand	Granular	Very friable

Notes:

[1] Based on characteristics of individual soil inspections of the described soil series, rather than all soil inspections that occur within the mapped soil unit.

B.2.3 Beaverley

Extent (ha/ %)	BVY: 1.3 ha / 5.8%
Soil Classification	Orthic Gray Luvisol
Parent Material	Glaciolacustrine
Dominant Texture (topsoil / subsoil)[1]	Silt loam / Silty clay
Slope Class / Percent Slope Range	4-6 / 6-30%
Drainage Class Range	Moderately well
Topsoil Depth	30 cm
Land Use	Forested
Dominant Colour Transition (topsoil / subsoil) (distinct / indistinct)[1]	Brown / dark grayish brown (distinct)

PROFILE SITE: BP008 (BVY)[1]

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence
LFH	7-0	-	-	-	-
Ae	0-23	Brown	Silt loam	Platy	Friable
Bt	23-58	Dark grayish brown	Silty clay	Subangular blocky	Firm
C	58-100	Olive brown	Silt loam	Massive	Firm

Notes:

[1] Based on characteristics of individual soil inspections of the described soil series, rather than all soil inspections that occur within the mapped soil unit.

B.2.4 Bednesti

Extent (ha/ %)	BDT: 1.0 ha / 4.3%
Soil Classification	Brunisolic Gray Luvisol
Parent Material	Glaciolacustrine/Fluvial
Dominant Texture (topsoil / subsoil)[1]	Sandy loam, loamy sand / loamy coarse sand, silt loam
Slope Class / Percent Slope Range	2-4 / 2-9%
Drainage Class Range	Well to moderately well
Topsoil Depth	15 cm
Land Use	Pasture, Forested
Dominant Colour Transition (topsoil / subsoil) (distinct / indistinct)[1]	Very dark grayish brown / brown; dark grayish brown (distinct)

PROFILE SITE: BP002 (BDT)[1]

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence
Ap	0-15	Very dark grayish brown	Loamy sand	Granular	Very friable
Bm	15-48	Brown	Loamy coarse sand	Platy	Very friable
Btj	48-69	Dark grayish brown	Silt loam	Subangular blocky	Friable
BC	69-90	Dark yellowish brown	Silty clay	Massive	Friable
IIC	90-100	Dark grayish brown	Loamy sand	Single Grain	Loose

Notes:

[1] Based on characteristics of individual soil inspections of the described soil series, rather than all soil inspections that occur within the mapped soil unit.

B.2.5 McGregor-Gleyed

Extent (ha/ %)	MGRgl: 0.9 / 4.1%
Soil Classification	Gleyed Cumulic Regosol
Parent Material	Fluvial
Dominant Texture (topsoil / subsoil)[1]	Fine sandy loam
Slope Class / Percent Slope Range	1-2 / 0 - 2.5%
Drainage Class Range	Imperfect - poor
Topsoil Depth	30 cm
Land Use	Forested (wetland)
Dominant Colour Transition (topsoil / subsoil) (distinct / indistinct)[1]	Greenish gray (indistinct)

PROFILE SITE: BP014 (MGRgl)[1]

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence
Cg	0-8	Greenish gray	Fine sandy loam	Massive	Slightly sticky
Omb	8-19	-	-	-	-
Cg	19-100	Greenish gray	very fine sandy loam	massive	Slightly sticky

Notes:
[1] Based on characteristics of individual soil inspections of the described soil series, rather than all soil inspections that occur within the mapped soil unit.

B.2.6 Abandoned Land

Extent (ha/ %)	ZAL: 1.7 ha / 7.5%
Soil Classification	Orthic Eutric Brunisol, Disturbed Land
Parent Material	Fluvial
Dominant Texture (topsoil / subsoil)[1]	Loamy sand / sand
Slope Class / Percent Slope Range	2 / 0.5 - 2.5 %
Drainage Class Range	Rapid - Well
Topsoil Depth	14 cm
Land Use	Pasture, Disturbed Land
Dominant Colour Transition (topsoil / subsoil) (distinct / indistinct)[1]	Very dark grayish brown / dark yellowish brown (indistinct)

PROFILE SITE: BP009 (ZAL)[1]

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence
Ap	0-14	Very dark grayish brown	Loamy sand	Granular	Very friable
Bm	14-32	Dark yellowish brown	Sand	Single grain	Loose
C	32-50	Dark yellowish brown	Sand	Single grain	Loose

Notes:

[1] Based on characteristics of individual soil inspections of the described soil series, rather than all soil inspections that occur within the mapped soil unit.

Appendix C Soil Laboratory Report and Certificate of Analysis, Bureau Veritas Canada Inc.

Your Project #: 115822030
Site#: CRRP-BASTIN PIT
Site Location: 102003.256520R
Your C.O.C. #: G165029

Attention: Blair Angelstad

STANTEC CONSULTING LTD
11-2042 Mills Road
Sidney, BC
CANADA V8L 5X4

Report Date: 2023/06/12
Report #: R3348923
Version: 3 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C336471
Received: 2023/05/20, 09:00

Sample Matrix: Soil
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Cation/EC Ratio	6	N/A	2023/05/29		Auto Calc
Chloride (Soluble)	6	2023/05/27	2023/05/28	AB SOP-00033 / AB SOP-00020	SM 24-4500-Cl-E m
Conductivity @25C (Soluble)	6	2023/05/28	2023/05/28	AB SOP-00033 / AB SOP-00004	SM 23 2510 B m
Sum of Cations, Anions	6	N/A	2023/05/29		Auto Calc
Potassium (Available)	3	2023/06/05	2023/06/05	CAL SOP-00153 / AB SOP-00042	EPA 6010d R5 m
Moisture	1	N/A	2023/05/27	AB SOP-00002	CCME PHC-CWS m
Moisture	2	N/A	2023/05/28	AB SOP-00002	CCME PHC-CWS m
Available NO3 (N)	3	2023/05/24	2023/06/07		Auto Calc
Phosphorus (Available by ICP)	3	2023/06/05	2023/06/05	CAL SOP-00152 / AB SOP-00042	EPA 6010d R5 m
pH @25C (1:2 Calcium Chloride Extract)	6	2023/05/26	2023/05/26	AB SOP-00033 / AB SOP-00006	SM 23 4500 H+B m
Sodium Adsorption Ratio	6	N/A	2023/05/29		Auto Calc
Soluble Ions	6	2023/05/27	2023/05/28	AB SOP-00033 / AB SOP-00042	EPA 6010d R5 m
Sulphur (Available)	3	2023/06/05	2023/06/05	AB SOP-00029 / AB SOP-00042	EPA 6010d R5 m
Soluble Paste	6	2023/05/27	2023/05/27	AB SOP-00033	Carter 2nd ed 15.2 m
Soluble Ions Calculation	6	N/A	2023/05/26		Auto Calc
Total Organic Carbon LECO Method	3	N/A	2023/05/26	CAL SOP-00243	LECO 203-821-498 m
Texture by Hydrometer	1	N/A	2023/05/26	AB SOP-00030	Carter 2nd ed 55.3 m
Texture by Hydrometer	5	N/A	2023/05/27	AB SOP-00030	Carter 2nd ed 55.3 m
Texture Class	1	N/A	2023/05/26		Auto Calc
Texture Class	5	N/A	2023/05/27		Auto Calc
Theoretical Gypsum Requirement (1)	6	N/A	2023/05/29		Auto Calc

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 115822030
Site#: CRRP-BASTIN PIT
Site Location: 102003.256520R
Your C.O.C. #: G165029

Attention: Blair Angelstad
STANTEC CONSULTING LTD
11-2042 Mills Road
Sidney, BC
CANADA V8L 5X4

Report Date: 2023/06/12
Report #: R3348923
Version: 3 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C336471
Received: 2023/05/20, 09:00

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) TGR calculation is based on a theoretical SAR of 4. Salt Contamination and Assessment and remediation guideline 2001 recommended SAR is ranging 4-8. TGR is reported in tonnes/ha.

Encryption Key

AUTHORIZED REPORT
RAPPORT AUTORISÉ

Bureau Veritas
12 Jun 2023 23:08:13

Please direct all questions regarding this Certificate of Analysis to:
Geraldlyn Gouthro, Key Account Specialist
Email: geraldlyn.gouthro@bureauveritas.com
Phone# (780)577-7173

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Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Scott Cantwell, General Manager responsible for Alberta Environmental laboratory operations.

Bureau Veritas Job #: C336471
Report Date: 2023/06/12

STANTEC CONSULTING LTD
Client Project #: 115822030
Site Location: 102003.256520R
Sampler Initials: BA

SOIL SALINITY 4 (SOIL)

Bureau Veritas ID		BQW436		BQW437		BQW438		BQW440		
Sampling Date		2023/05/17		2023/05/17		2023/05/17		2023/05/17		
COC Number		G165029		G165029		G165029		G165029		
	UNITS	BP004-AP	RDL	BP004-BM	RDL	BP004-C	RDL	BP008-AE	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	0.30	N/A	0.11	N/A	0.0000	N/A	0.18	N/A	A970656
Cation Sum	meq/L	2.6	N/A	1.6	N/A	1.1	N/A	1.1	N/A	A970656
Cation/EC Ratio	N/A	13	0.10	16	0.10	17	0.10	12	0.10	A969920
Calculated Calcium (Ca)	mg/kg	15	0.69	5.3	0.46	2.8	0.40	2.4	0.54	A970658
Calculated Magnesium (Mg)	mg/kg	2.4	0.46	0.79	0.30	0.47	0.27	0.44	0.36	A970658
Calculated Sodium (Na)	mg/kg	4.6	1.2	3.9	0.76	2.4	0.66	4.2	0.89	A970658
Calculated Potassium (K)	mg/kg	1.7	0.60	<0.39	0.39	0.53	0.35	2.2	0.47	A970658
Calculated Chloride (Cl)	mg/kg	<4.6	4.6	<3.0	3.0	<2.7	2.7	<3.6	3.6	A970658
Calculated Sulphate (SO4)	mg/kg	6.6	2.3	1.7	1.5	<1.3	1.3	3.2	1.8	A970658
Soluble Parameters										
Soluble Chloride (Cl)	mg/L	<10	10	<10	10	<10	10	<10	10	A975010
Soluble Conductivity	dS/m	0.19	0.020	0.10	0.020	0.067	0.020	0.090	0.020	A975002
Soluble (CaCl2) pH	pH	6.07	N/A	6.52	N/A	6.68	N/A	5.58	N/A	A972563
Sodium Adsorption Ratio	N/A	0.43	0.10	0.76	0.10	0.68	0.10	1.1	0.10	A970657
Soluble Calcium (Ca)	mg/L	32	1.5	17	1.5	11	1.5	6.6	1.5	A975022
Soluble Magnesium (Mg)	mg/L	5.2	1.0	2.6	1.0	1.8	1.0	1.2	1.0	A975022
Soluble Sodium (Na)	mg/L	9.9	2.5	13	2.5	9.1	2.5	12	2.5	A975022
Soluble Potassium (K)	mg/L	3.6	1.3	<1.3	1.3	2.0	1.3	6.1	1.3	A975022
Saturation %	%	46	N/A	30	N/A	27	N/A	36	N/A	A972561
Soluble Sulphate (SO4)	mg/L	14	5.0	5.5	5.0	<5.0	5.0	8.9	5.0	A975022
Theoretical Gypsum Requirement	tonnes/ha	<0.20	0.20	<0.20	0.20	<0.20	0.20	<0.20	0.20	A970659

RDL = Reportable Detection Limit
N/A = Not Applicable

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SOIL SALINITY 4 (SOIL)

Bureau Veritas ID		BQW441		BQW442		
Sampling Date		2023/05/17		2023/05/17		
COC Number		G165029		G165029		
	UNITS	BP008-BT	RDL	BP008-C	RDL	QC Batch
Calculated Parameters						
Anion Sum	meq/L	0.30	N/A	0.17	N/A	A970656
Cation Sum	meq/L	1.1	N/A	0.47	N/A	A970656
Cation/EC Ratio	N/A	12	0.10	9.9	0.10	A969920
Calculated Calcium (Ca)	mg/kg	2.4	0.59	0.52	0.41	A970658
Calculated Magnesium (Mg)	mg/kg	0.57	0.39	<0.28	0.28	A970658
Calculated Sodium (Na)	mg/kg	5.1	0.99	2.3	0.69	A970658
Calculated Potassium (K)	mg/kg	2.0	0.51	<0.36	0.36	A970658
Calculated Chloride (Cl)	mg/kg	<3.9	3.9	<2.8	2.8	A970658
Calculated Sulphate (SO4)	mg/kg	5.6	2.0	2.2	1.4	A970658
Soluble Parameters						
Soluble Chloride (Cl)	mg/L	<10	10	<10	10	A975010
Soluble Conductivity	dS/m	0.096	0.020	0.047	0.020	A975002
Soluble (CaCl2) pH	pH	5.83	N/A	6.76	N/A	A972563
Sodium Adsorption Ratio	N/A	1.2	0.10	1.7	0.10	A970657
Soluble Calcium (Ca)	mg/L	6.2	1.5	1.9	1.5	A975022
Soluble Magnesium (Mg)	mg/L	1.5	1.0	<1.0	1.0	A975022
Soluble Sodium (Na)	mg/L	13	2.5	8.5	2.5	A975022
Soluble Potassium (K)	mg/L	5.1	1.3	<1.3	1.3	A975022
Saturation %	%	39	N/A	28	N/A	A972561
Soluble Sulphate (SO4)	mg/L	14	5.0	8.0	5.0	A975022
Theoretical Gypsum Requirement	tonnes/ha	<0.20	0.20	<0.20	0.20	A970659

RDL = Reportable Detection Limit
N/A = Not Applicable

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NPKS (AVAILABLE)

Bureau Veritas ID		BQW436		BQW439		BQW440	BQW440		
Sampling Date		2023/05/17		2023/05/17		2023/05/17	2023/05/17		
COC Number		G165029		G165029		G165029	G165029		
	UNITS	BP004-AP	RDL	BP008-LFH	RDL	BP008-AE	BP008-AE Lab-Dup	RDL	QC Batch
Calculated Parameters									
Available (NH4F) Nitrate (N)	mg/kg	<4.0	4.0	<20	20	4.1	N/A	4.0	A970335
Nutrients									
Available (NH4F) Phosphorus (P)	mg/kg	50	1.0	540	5.0	74	79	1.0	A983663
Available (NH4OAc) Potassium (K)	mg/kg	58	2.0	350	10	210	200	2.0	A983677
Available (CaCl2) Sulphur (S)	mg/kg	<2.0	2.0	<20	20	<2.0	N/A	2.0	A983683

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Bureau Veritas Job #: C336471
Report Date: 2023/06/12

STANTEC CONSULTING LTD
Client Project #: 115822030
Site Location: 102003.256520R
Sampler Initials: BA

PHYSICAL TESTING (SOIL)

Bureau Veritas ID		BQW436		BQW437	BQW438	BQW439	BQW440		
Sampling Date		2023/05/17		2023/05/17	2023/05/17	2023/05/17	2023/05/17		
COC Number		G165029		G165029	G165029	G165029	G165029		
	UNITS	BP004-AP	QC Batch	BP004-BM	BP004-C	BP008-LFH	BP008-AE	RDL	QC Batch
Physical Properties									
% sand by hydrometer	%	57	A973317	52	76	N/A	17	2.0	A974552
% silt by hydrometer	%	33	A973317	39	18	N/A	57	2.0	A974552
Clay Content	%	10	A973317	9.5	6.2	N/A	27	2.0	A974552
Texture	N/A	SANDY LOAM	A970339	LOAM	SANDY LOAM	N/A	SILT LOAM	N/A	A970339
Moisture	%	15	A974362	N/A	N/A	42	19	0.30	A974374

RDL = Reportable Detection Limit
N/A = Not Applicable

Bureau Veritas ID		BQW440	BQW441	BQW442		
Sampling Date		2023/05/17	2023/05/17	2023/05/17		
COC Number		G165029	G165029	G165029		
	UNITS	BP008-AE Lab-Dup	BP008-BT	BP008-C	RDL	QC Batch
Physical Properties						
% sand by hydrometer	%	N/A	9.8	29	2.0	A974552
% silt by hydrometer	%	N/A	48	53	2.0	A974552
Clay Content	%	N/A	42	18	2.0	A974552
Texture	N/A	N/A	SILTY CLAY	SILT LOAM	N/A	A970339
Moisture	%	19	N/A	N/A	0.30	A974374

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

MISCELLANEOUS (SOIL)

Bureau Veritas ID		BQW436	BQW436	BQW439	BQW440		
Sampling Date		2023/05/17	2023/05/17	2023/05/17	2023/05/17		
COC Number		G165029	G165029	G165029	G165029		
	UNITS	BP004-AP	BP004-AP Lab-Dup	BP008-LFH	BP008-AE	RDL	QC Batch
Misc. Inorganics							
Total Organic Carbon (C)	%	2.5	2.7	8.2	0.53	0.050	A972880

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

GENERAL COMMENTS

NPKS (AVAILABLE) Comments

Sample BQW439 [BP008-LFH] Phosphorus (Available by ICP): Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
Sample BQW439 [BP008-LFH] Potassium (Available): Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Results relate only to the items tested.

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A972561	STB	QC Standard	Saturation %	2023/05/27		98	%	75 - 125
A972561	STB	RPD	Saturation %	2023/05/27	1.2		%	12
A972563	DPL	QC Standard	Soluble (CaCl2) pH	2023/05/26		102	%	97 - 103
A972563	DPL	Spiked Blank	Soluble (CaCl2) pH	2023/05/26		100	%	97 - 103
A972563	DPL	RPD	Soluble (CaCl2) pH	2023/05/26	0.23		%	N/A
A972880	PL	QC Standard	Total Organic Carbon (C)	2023/05/26		102	%	75 - 125
A972880	PL	Spiked Blank	Total Organic Carbon (C)	2023/05/26		101	%	80 - 120
A972880	PL	Method Blank	Total Organic Carbon (C)	2023/05/26	<0.050		%	
A972880	PL	RPD [BQW436-01]	Total Organic Carbon (C)	2023/05/26	8.1		%	35
A973317	EH2	QC Standard	% sand by hydrometer	2023/05/26		98	%	75 - 125
			% silt by hydrometer	2023/05/26		104	%	75 - 125
			Clay Content	2023/05/26		101	%	75 - 125
A973317	EH2	RPD	% sand by hydrometer	2023/05/26	0.34		%	30
			% silt by hydrometer	2023/05/26	2.0		%	30
			Clay Content	2023/05/26	2.4		%	30
A974362	SIB	Method Blank	Moisture	2023/05/27	<0.30		%	
A974362	SIB	RPD	Moisture	2023/05/27	11		%	20
A974374	SIB	Method Blank	Moisture	2023/05/28	<0.30		%	
A974374	SIB	RPD [BQW440-01]	Moisture	2023/05/28	3.2		%	20
A974552	RDL	QC Standard	% sand by hydrometer	2023/05/27		101	%	75 - 125
			% silt by hydrometer	2023/05/27		103	%	75 - 125
			Clay Content	2023/05/27		96	%	75 - 125
A974552	RDL	RPD	% sand by hydrometer	2023/05/27	4.6		%	30
			% silt by hydrometer	2023/05/27	3.1		%	30
			Clay Content	2023/05/27	3.3		%	30
A975002	STB	QC Standard	Soluble Conductivity	2023/05/28		112	%	75 - 125
A975002	STB	Spiked Blank	Soluble Conductivity	2023/05/28		99	%	90 - 110
A975002	STB	Method Blank	Soluble Conductivity	2023/05/28	<0.020		dS/m	
A975002	STB	RPD	Soluble Conductivity	2023/05/28	1.1		%	20
A975010	AFI	Matrix Spike	Soluble Chloride (Cl)	2023/05/28		108	%	75 - 125
A975010	AFI	QC Standard	Soluble Chloride (Cl)	2023/05/28		98	%	75 - 125
A975010	AFI	Spiked Blank	Soluble Chloride (Cl)	2023/05/28		105	%	80 - 120
A975010	AFI	Method Blank	Soluble Chloride (Cl)	2023/05/28	<10		mg/L	
A975010	AFI	RPD	Soluble Chloride (Cl)	2023/05/28	2.9		%	30
A975022	KKC	Matrix Spike	Soluble Calcium (Ca)	2023/05/28		97	%	75 - 125
			Soluble Magnesium (Mg)	2023/05/28		99	%	75 - 125
			Soluble Sodium (Na)	2023/05/28		96	%	75 - 125
			Soluble Potassium (K)	2023/05/28		98	%	75 - 125
A975022	KKC	QC Standard	Soluble Calcium (Ca)	2023/05/28		94	%	75 - 125
			Soluble Magnesium (Mg)	2023/05/28		102	%	75 - 125
			Soluble Sodium (Na)	2023/05/28		104	%	75 - 125
			Soluble Potassium (K)	2023/05/28		108	%	75 - 125
			Soluble Sulphate (SO4)	2023/05/28		100	%	75 - 125
A975022	KKC	Spiked Blank	Soluble Calcium (Ca)	2023/05/28		98	%	80 - 120
			Soluble Magnesium (Mg)	2023/05/28		100	%	80 - 120
			Soluble Sodium (Na)	2023/05/28		97	%	80 - 120
			Soluble Potassium (K)	2023/05/28		99	%	80 - 120
A975022	KKC	Method Blank	Soluble Calcium (Ca)	2023/05/28	<1.5		mg/L	
			Soluble Magnesium (Mg)	2023/05/28	<1.0		mg/L	
			Soluble Sodium (Na)	2023/05/28	<2.5		mg/L	
			Soluble Potassium (K)	2023/05/28	<1.3		mg/L	
			Soluble Sulphate (SO4)	2023/05/28	<5.0		mg/L	
A975022	KKC	RPD	Soluble Calcium (Ca)	2023/05/28	2.4		%	30

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Soluble Magnesium (Mg)	2023/05/28	3.0		%	30
			Soluble Sodium (Na)	2023/05/28	16		%	30
			Soluble Potassium (K)	2023/05/28	6.2		%	30
			Soluble Sulphate (SO4)	2023/05/28	4.7		%	30
A983663	VSC	Matrix Spike [BQW440-01]	Available (NH4F) Phosphorus (P)	2023/06/05		NC	%	75 - 125
A983663	VSC	Spiked Blank	Available (NH4F) Phosphorus (P)	2023/06/05		105	%	80 - 120
A983663	VSC	Method Blank	Available (NH4F) Phosphorus (P)	2023/06/05	<1.0		mg/kg	
A983663	VSC	RPD [BQW440-01]	Available (NH4F) Phosphorus (P)	2023/06/05	7.2		%	35
A983677	MPU	Matrix Spike [BQW440-01]	Available (NH4OAc) Potassium (K)	2023/06/05		99	%	75 - 125
A983677	MPU	Spiked Blank	Available (NH4OAc) Potassium (K)	2023/06/05		100	%	80 - 120
A983677	MPU	Method Blank	Available (NH4OAc) Potassium (K)	2023/06/05	<2.0		mg/kg	
A983677	MPU	RPD [BQW440-01]	Available (NH4OAc) Potassium (K)	2023/06/05	3.4		%	35
A983683	VSC	Matrix Spike	Available (CaCl2) Sulphur (S)	2023/06/05		94	%	75 - 125
A983683	VSC	QC Standard	Available (CaCl2) Sulphur (S)	2023/06/05		100	%	75 - 125
A983683	VSC	Spiked Blank	Available (CaCl2) Sulphur (S)	2023/06/05		91	%	80 - 120
A983683	VSC	Method Blank	Available (CaCl2) Sulphur (S)	2023/06/05	<2.0		mg/kg	
A983683	VSC	RPD	Available (CaCl2) Sulphur (S)	2023/06/05	0.41		%	35

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

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Bureau Veritas Job #: C336471
Report Date: 2023/06/12

STANTEC CONSULTING LTD
Client Project #: 115822030
Site Location: 102003.256520R
Sampler Initials: BA

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

[redacted]
Sandy Yuan, M.Sc., QP, Scientific Specialist

[redacted]
Suwan (Sze Yeung) Fock, B.Sc., Scientific Specialist

[redacted]
Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

[redacted]
Automated Statchk

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consulting sitkum GEOTECHNICAL SERVICES
221 Victoria Street, Kamloops, BC, V2C 2A1
Phone: 250-574-0285
Email: Main_Street_Aggregates@shaw.ca

Bastin Pit No. 1471

December 2023 Technical Information Report

Introduction:

At the request of Mr. Steven Lee, Senior Aggregate Resource Specialist, MoTI Southern Interior Region, a test pitting program was completed at Bastin Pit No. 1471on August 14, 15 and 16, 2023. A total of 24 test pits were excavated utilizing a John Deere 200DLC excavator hired from 522828 BC Ltd. (Norm Purmal). Test pits were visually inspected to determine approximate gravel, sand and fines contents as well as the percentage of oversize rock (>75mm) that is present. Sieve Analysis and aggregate quality tests on samples obtained were completed by WSP Engineering of Prince George, BC. Test pit locations, tree lines, slopes, etc. were surveyed by hand held Garmin GPSMAP 64s unit.
The following report documents material encountered within the testing area and provides recommendations on aggregate suitability, available volumes as well as development, mining and final reclamation procedures.

Location:

The pit is located approximately 23km southeast of the Highway 97/Quesnel -Hendrix Road junction in Quesnel via the Quesnel-Hendrix Road then approximately 1km northeast on the Nyland Lake Road to the pit entrance.

Location Plan

Legal Description:

Bastin Pit was purchased by the Ministry of Transportation and Infrastructure in 2022 as part of the Nyland Lake Road Slide Remediation Project. The pit site coverers approximately 16 hectares with Part of the SW1/4, District Lot 9159, Cariboo Land District, Except Plans BCP28576, EPP21640, EPP21641, EPP21642. The UTM co-ordinates at the gate to the pit entrance is Zone 10, 5855299 Northing, 552583 Easting. The pit is located with the Province of British Columbia Agricultural Land Reserve.

Geomorphological Setting:

Bastin Pit is contained with a glacio-fluvial terrace lying adjacent to the Quesnel River. The deposit consists of a small lower terrace at an approximate elevation of 575 metres and a larger terrace to the southwest lying approximately 7 metres higher at a general elevation of 682 metres. The eastern edge of the glacio-fluvial terrace is covered by high fines colluvium material deposited from slopes to the east. The northern portion of the property has an area that was previously mined for aggregate resources. Rocks observed within the deposit were primarily well rounded and of good quality.

Gradation:

The pit has been divided into two separate development phases referred to as Phase 1 and 2 in order to maximize the material contained within the pit as well as develop and reclaim the site to current Agricultural Land Commission standards. Development Phase 1 is comprised of the lower terrace. Phase 2 consists of the upper terrace lying to the southwest.
The average and range of laboratory sieve analysis as well as oversize rock field estimates for the test pits are as follows:

Phase 1 (Lower Terrace):

Laboratory Gradations (Test Pits 23-01, 02, 03, 04, 05, and 24)

Classification:	Average (%)	Range (%)
Gravel (4.75-75mm)	70.2	63.1-77.1
Sand (0.075-4.75mm)	28.3	21.4-35.6
Fines (<0.075mm)	1.5	0.5-2.6

Visual Oversize Rock Estimates (Test Pits 23-01, 02, 03, 04, 05, and 24)

Classification:	Average (%)	Range (%)
Boulders (>375mm)	<0.1	0-<1
Cobbles (150-375mm)	1.0	0-5
Cobbles (75-150mm)	5.2	0-15

The maximum size rock observed within Phase 1 was 350 mm.

Phase 2 (Upper Terrace):

Laboratory Gradations (Test Pits 23-06, 07, 08, 09, 12, 13, 14, 15, 16, 17, 18 and 19)

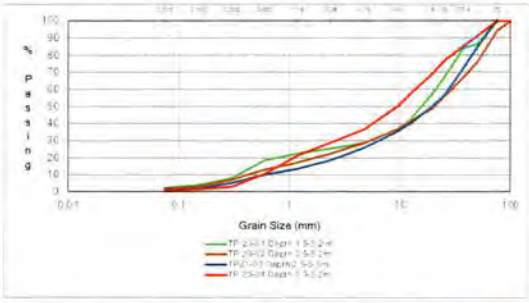
Classification:	Average (%)	Range (%)
Gravel (4.75-75mm)	69.4	60.7-75.7
Sand (0.075-4.75mm)	28.8	22.1-37.6
Fines (<0.075mm)	1.8	1.1-2.6

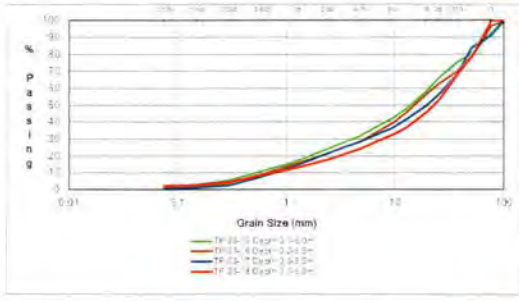
Visual Oversize Rock Estimates (Test Pits 23-06, 07, 08, 09, 12, 13, 14, 15, 16, 17, 18 and 19)

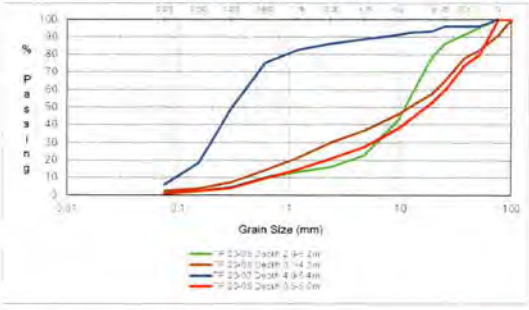
Classification:	Average (%)	Range (%)
Boulders (>375mm)	0	0
Cobbles (150-375mm)	2.9	0-10
Cobbles (75-150mm)	11.5	<1-15

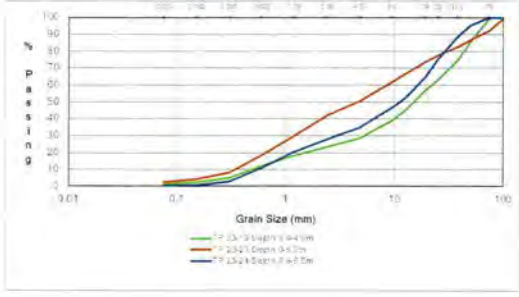
The maximum size rock observed within Phase 2was 250 mm.

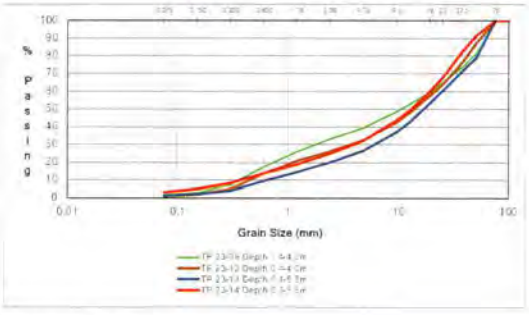
Pit Run Gradation Charts (*Not corrected for oversize rock (>75mm):*











Gradation Details:

Sample Information		Percent Passing														
Test Pit	Depth	Pit Run Sieve Sizes (mm)														
		100	75	50	37.5	25	19	12.5	9.5	4.75	2.36	1.18	0.6	0.3	0.15	0.075
TP 23-01	Depth 1.5-5.2 m	100.0	100.0	86.5	84.2	67.3	56.2	42.4	37.2	29.0	25.7	22.5	18.9	8.2	4.2	2.6
TP 23-02	Depth 0.5-5.2m	100.0	94.3	76.1	67.7	55.9	48.5	41.4	37.2	29.0	22.6	17.3	13.2	7.5	3.4	1.9
TP21-03	Depth 0.5-5.5m	100.0	100.0	84.9	72.9	56.6	49.3	40.4	35.4	26.0	18.9	13.4	10.1	5.4	2.3	1.3
TP 23-04	Depth 0.3-5.2m	100.0	100.0	91.4	85.4	77.2	68.7	57.9	50.3	36.9	29.3	21.3	10.9	3.2	1.8	1.3
TP 23-05	Depth 2.0-5.2m	100.0	100.0	95.3	91.8	86.2	77.9	56.9	43.0	22.9	16.4	13.5	10.3	4.5	2.4	1.5
TP 23-06	Depth 0.1-4.2m	100.0	91.1	82.4	78.2	65.5	57.8	50.8	46.4	37.2	30.2	21.3	14.5	7.5	3.9	2.6
TP 23-07	Depth 4.0-5.4m	100.0	100.0	96.0	96.0	96.0	93.4	92.5	91.3	88.7	86.3	82.6	75.3	49.5	18.5	6.2
TP 23-08	Depth 0.5-5.0m	100.0	100.0	79.8	74.0	59.9	52.6	43.7	38.4	27.7	21.1	14.6	9.6	4.2	2.1	1.1
TP 23-09	Depth 1.4-4.0m	100.0	100.0	81.7	73.8	65.7	59.6	52.8	48.6	39.3	33.5	26.0	17.8	7.7	3.1	1.7
TP 23-12	Depth 0.4-4.0m	100.0	100.0	87.5	77.0	64.1	57.7	48.2	42.7	32.6	26.3	20.7	13.8	4.9	1.9	1.1
TP 23-13	Depth 0.1-5.5m	100.0	100.0	78.9	72.0	60.7	53.3	42.8	36.9	26.6	20.1	14.4	9.4	4.2	2.2	1.4
TP 23-14	Depth 0.3-5.5m	100.0	100.0	91.6	83.2	68.2	60.0	49.6	43.6	32.2	24.8	18.7	13.7	8.2	4.9	3.2
TP 23-15	Depth 0.7-6.0m	100.0	92.4	80.5	75.7	66.1	58.0	47.8	42.6	31.9	24.2	16.7	11.2	5.8	3.1	2.1
TP 23-16	Depth 0.21-5.5m	100.0	96.7	79.1	70.7	62.9	56.5	45.6	39.7	28.6	21.7	15.4	9.5	4.1	2.1	1.4
TP 23-17	Depth 0.2-5.5m	100.0	91.2	84.2	69.0	56.4	49.7	41.4	36.7	28.4	21.6	14.1	7.9	2.7	1.3	0.8
TP 23-18	Depth 0.7-5.0m	100.0	100.0	79.0	69.2	53.2	46.0	36.7	32.6	24.3	17.7	12.8	9.1	4.6	2.9	2.2
TP 23-19	Depth 0.4-4.0m	100.0	100.0	85.9	74.8	63.2	57.0	45.3	39.4	28.6	23.5	18.5	12.5	5.3	2.5	1.5
TP 23-23	Depth 0-5.0m	100.0	92.5	87.0	82.6	77.8	73.7	66.6	62.0	50.8	41.8	29.8	18.7	8.4	4.2	2.5
TP 23-24	Depth 0.9-5.5m	100.0	100.0	95.4	88.5	75.5	64.4	52.4	46.8	34.9	27.8	20.7	11.2	2.8	0.9	0.5

Laboratory Aggregate Quality Test Results:

Test Pit	Laboratory Test					
	Micro Deval	Sand Equivalent	Magnesium Suphate	Bulk Relative Density	Absorption	Clay Lumps
TP 23-02						0.2%
TP 23-04	6.8%	68		2.694 Coarse 2.663 Fine	1.21% Coarse 1.49% Fine	
TP 23-08			4.7% Coarse	2.749 Coarse	0.53% Coarse	0.3%
TP 23-11	6.5%	73				
TP 23-15				2.650 Coarse 2.625 Fine	2.0% Coarse. 2.19% Fine	
TP 23-16	6.5%	65				0.2%

Laboratory testing indicates the pit contains good quality material with fines that are non-plastic in nature.

MoTI Aggregate Quality Specifications:

Product	Laboratory Test					
	Micro Deval	Sand Equivalent	Magnesium Sulphate	Absorption	Clay Lumps	Plasticity
25mm Well Graded Base	<25%	>40	<20% Coarse, <25% Fine			
50mm Well Graded Base	<25%	>40	<20% Coarse, <25% Fine			
75mm Well Graded Base	<17%	>40	<20% Coarse, <25% Fine			
Select Granular Sub base	<30%	>20	<20% Coarse, <25% Fine			
Bridge End Fill	<30%	>20	<20% Coarse, <25% Fine			
Superpave	<18%	>45		2.0%	1.0%	
Class 1 Asphalt	<18%	>40		2.0%	1.0%	
Class 2 Asphalt	<20%	>40		2.0%	1.5%	
Graded Aggregate Seal	<20%		12%	1.0% Coarse, 1.5% Fine	0.5%	
High Fines Surfacing	<25%	>20				<6

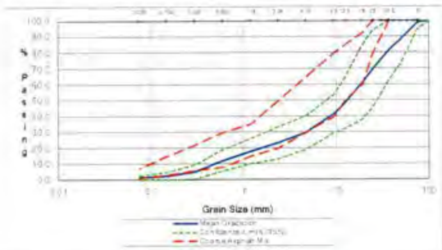
Phase 1 - Suggested Material Suitability:

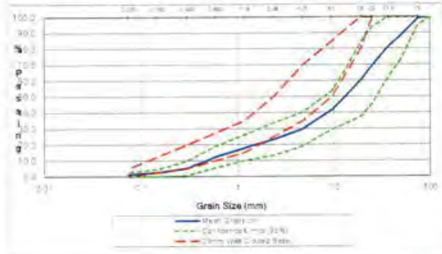
- Coarse Asphalt Mix
- Medium Asphalt Mix
- Class B and C Graded Aggregate Seal
- 25mm Well Graded Base
- 50mm Well Graded Base
- Select Granular Sub base
- Bridge End Fill

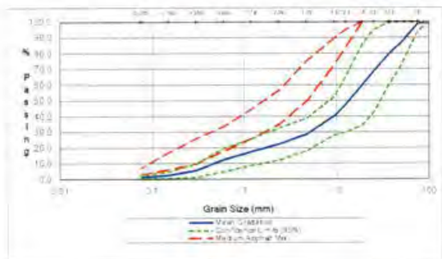
Notes:

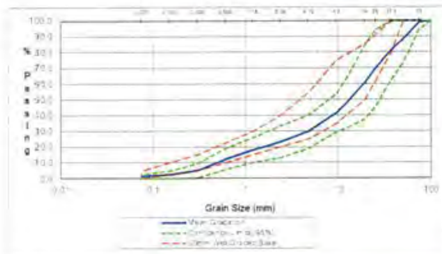
- *It will be necessary to scalp off rock during crushing in order to produce specification 25mm Well Graded Base.*
- *It may be possible to produce High Fines Surfacing Aggregate by adding a suitable mineral filler as well as rejecting rock during production.*
- *Laboratory testing indicates the absorption percentage is variable and should be reviewed when producing Graded Aggregate Seal products.*

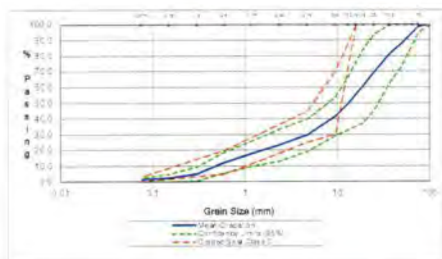
Phase 1 - Mean Gradations vs End Product Gradation Specifications:

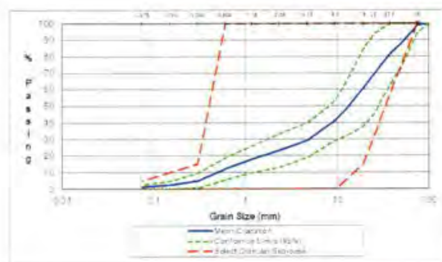


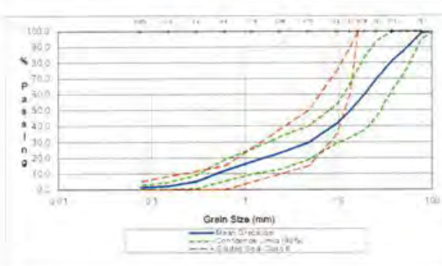


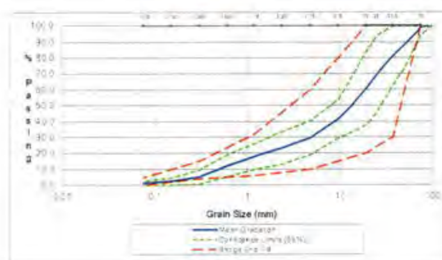












Note: Mean gradations have not been adjusted to include oversize rock (>75mm)

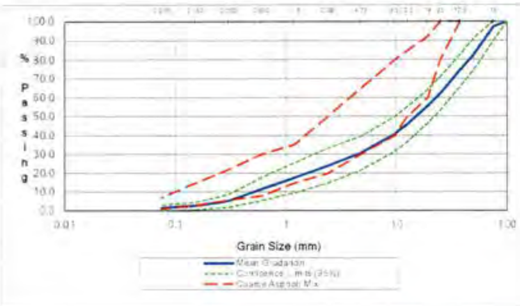
Phase 2 - Suggested Material Suitability:

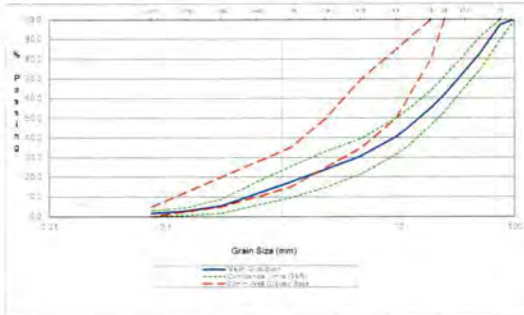
- Coarse Asphalt Mix
- Medium Asphalt Mix
- Class B and C Graded Aggregate Seal
- 25mm Well Graded Base
- 50mm Well Graded Base
- Select Granular Sub base
- Bridge End Fill

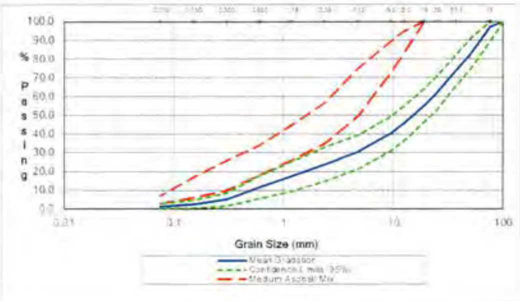
Notes:

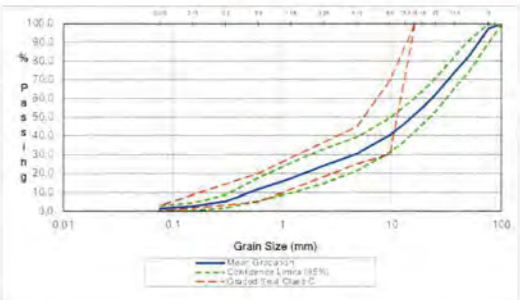
- *It will be necessary to scalp off rock during crushing in order to produce specification 25mm Well Graded Base.*
- *It may be possible to produce High Fines Surfacing Aggregate by adding a suitable mineral filler as well as rejecting rock during production.*
- *Laboratory testing indicates the absorption percentage is variable and should be reviewed when producing Graded Aggregate Seal products.*

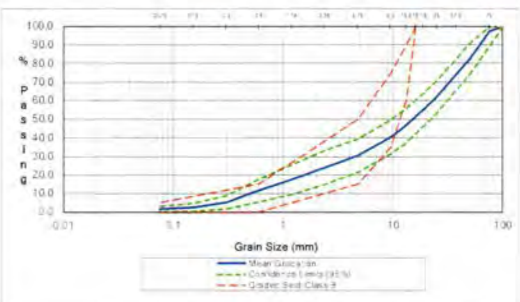
Phase 2 - Mean Gradations vs End Product Gradation Specifications:

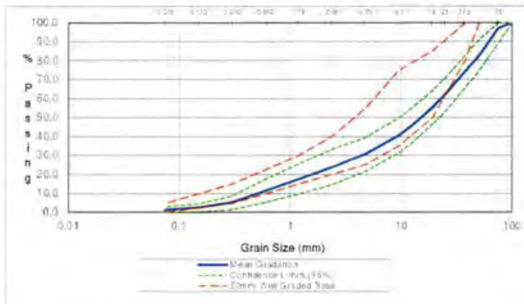


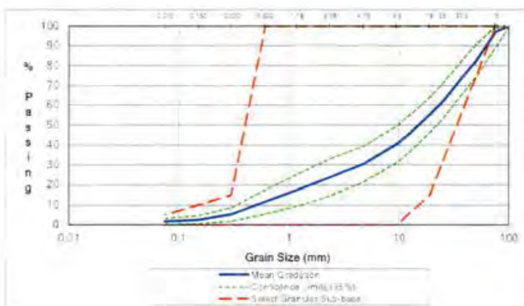


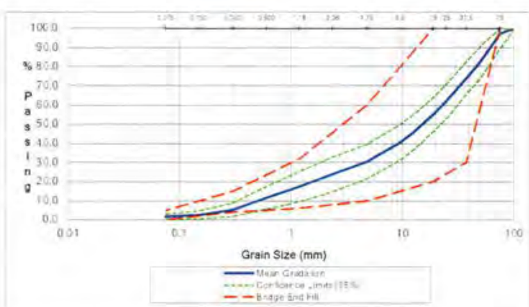












Estimated Granular and Overburden Volumes:

Phase 1 - Lower Terrace

- Sand and Gravel: +/-125,000m3

Based on mining the Lower Terrace, covering 2.7 hectares, to an average depth of 5.5 metres after topsoil and overburden has been removed and sloping the pit face to a minimum slope of 2:1.

- Topsoil and Overburden (combined): +/-17,400m3

Based on stripping the Lower Terrace in the vicinity of TP 23-01, 02, 03 and 04 to an average depth of 0.65 metres and TP 23-05 to a depth of 2.0 metres.

Phase 2 - Upper Terrace

- Sand and Gravel: +/-295,000m3

Based on mining the Upper Terrace, covering 7.3 hectares, to an average depth of 5.0 metres after topsoil and overburden has been removed and sloping the pit face to a minimum slope of 2:1.

- Topsoil and Overburden (combined): +/-24,800m3

Based on stripping the Upper Terrace to an average combined topsoil and overburden depth of 0.34 metres.

Test Pit GPS Co-ordinates:

Test Pit	GPS Co-ordinates – UTM Zone 10
23-01	5855110 Northing, 552600 Easting
23-02	5855052 Northing, 552528 Easting
23-03	5855002 Northing, 552484 Easting
23-04	5854988 Northing, 5525506 Easting
23-05	5855037 Northing, 552600 Easting
23-06	5854939 Northing, 552551 Easting
23-07	5854888 Northing, 552551 Easting
23-08	5854868 Northing, 552611 Easting
23-09	5854889 Northing, 552678 Easting
23-10	5854909 Northing, 552744 Easting
23-11	5854961 Northing, 552691 Easting
23-12	5855017 Northing, 552657 Easting
23-13	5854835 Northing, 5525556 Easting
23-14	5854787 Northing, 552610 Easting
23-15	5854809 Northing, 552673 Easting
23-16	5854745 Northing, 552660 Easting
23-17	5854685 Northing, 552641 Easting
23-18	5854701 Northing, 552716 Easting
22-19	5854632 Northing, 552688 Easting
23-20	5854767 Northing, 552722 Easting
23-21	5854838 Northing, 552730 Easting
22-22	5855086 Northing, 552473 Easting
22-23	5855166 Northing, 552501 Easting
22-24	5855195 Northing, 552611 Easting

Pit Development and Recommendations:

Phase 1 – Lower Terrace

- Phase 1 vegetation consists primarily of grasses with a thin canopy of deciduous and coniferous tress along the northern and western edges. Combined topsoil and overburden depths in the area range from a depth of 0.3 to 2.0 metres. Test pitting indicates that a small area near TP 23-02 has been previously stripped with the topsoil and overburden placed in the vicinity of TP 23-05. Prior to mining the perimeter trees to the north and west need to be removed and placed in piles for burning when the forest fire risk and venting indexes are appropriate.
  Topsoil and overburden shall be stripped to the depths and general operating procedures as outlined in the Stantec – Bastin Hill Pit Agricultural Soils Assessment September 2023 report.
- Topsoil is recommended to be placed in a neatly trimmed stockpile along the eastern edge of the Phase 1 mining area. After placement, the stockpile should be immediately seeded with a suitable seed mixture in order to prevent erosion and the spread of noxious weeds. Stripping of topsoil and overburden is recommended to be completed with an excavator and a clean-up bucket. Stripping should not be completed when the ground is saturated or when there are very dry, windy conditions.

- The crusher is recommended to be set up near Test Pit 23-24 with mining proceeding in a southwest direction. Initially, it will be necessary to excavate down to create a suitable mining face of approximately 6 metres in height.
- Initially, there will be limited aggregate stockpile space adjacent to the crusher site. If a large volume of aggregate is produced it is recommended that the material be placed in stockpile on the northern end of the Upper Terrace. It will be necessary to construct a new haul road to the Upper Terrace for initial aggregate stockpiling.
- At the completion of intermittent mining the pit face should be trimmed to a slope of 1 1/2:1 with natural sand and gravel. Slopes mined to depletion need to be trimmed to a minimum slope of 3 1/2:1 unless the Agricultural Land Commission approves a 2:1 slope.
- Reject material from aggregate production should not be used to obtain sloping. Reclamation activities at the pit are recommended to include sloping, loosening compacted areas via ripping or tilling, replacement of overburden and seeding with a suitable grass mixture.

Phase 2 – Upper Terrace

- Phase 2 vegetation consists primarily of grasses with a thin canopy of deciduous and coniferous tress along the western terrace edge. Combined topsoil and overburden depths in the area range from a depth of 0.3 to 2.0 metres. Prior to mining the perimeter trees need to be removed and placed in piles for burning when the forest fire risk and venting indexes are appropriate. Topsoil and overburden shall be stripped to the depths and general operating procedures as outlined in the Stantec – Bastin Hill Pit Agricultural Soils Assessment September 2023 report. Topsoil is recommended to be placed in a neatly trimmed stockpile along the eastern edge of the Phase 2 mining area. After placement, the stockpile should be immediately seeded with a suitable seed mixture in order to prevent erosion and the spread of noxious weeds. Stripping of topsoil and overburden is recommended to be completed with an excavator and a clean-up bucket. Stripping should not be completed when the ground is saturated or when there are very dry, windy conditions.
- There are some out buildings, power poles, fencing, etc. located on the Upper Terrace. These items will need to be removed in order to fully develop and mine the area.
- The crusher is recommended to be located at the base of slope near Test Pit 23-04 and 05 with mining proceeding in a southerly direction. Processed aggregate may be stockpiled near the crusher location where space permits.
- Clean, coarse granular material encountered within Test Pit 23-09 is underlain by high fines sand at a depth of 2.8 metres (prior to topsoil stripping). The lateral extent of the high fines sand is not known, therefore; careful attention to mining depths will be required when excavating near the area.
- The majority of test pits with Phase 2 encountered clay and silt materials near the bottom of the test pit excavations. As a result, mining depths will be limited to approximately 5 metres. Mining near this depth will require close monitoring in order to avoid contamination with clay and silt materials.
- At the completion of intermittent mining the pit face should be trimmed to a slope of 1 1/2:1 with natural sand and gravel. Slopes mined to depletion need to be trimmed to a minimum slope of 3 1/2:1 unless the Agricultural Land Commission approves a 2:1 slope.
- Reject material from aggregate production should not be used to obtain sloping. Reclamation activities at the pit are recommended to include sloping, loosening compacted areas via ripping or tilling, replacement of overburden and seeding with a suitable grass mixture.

Additional Recommendations:

- The northern portion of the property has been previously mined for aggregate products. The area has been recommended for the placement of waste material excavated from the nearby Nyland Lake Road slide remediation project. Prior to the placement of waste material, the area will require the removal of some deciduous and coniferous tress and underlying brush. Material should be placed in appropriate lifts and compacted in order to ensure stability of the fill. The top of the fill should be levelled, covered with approximately 0.3 metres of topsoil and seeded with an appropriate seed mixture.

Test Pit Logs:

TP	DEPTH		VISUAL MATERIAL DESCRIPTION	ESTIMATED GRADUATION			ESTIMATED ROCK >75mm				SAND TYPE	LABORATORY GRADATIONS and CLASSIFICATION	Comments
	FROM	TO		G	S	F	MAX SIZE	75mm - 150mm	150mm - 375mm	>375mm	F M C		
23-01	0.0	1.5	Overburden										
	1.5	5.2	GP	60	38	2	150	5	0	0	FM	**GP (71.0%G, 26.4%S, 2.6%F)**	
23-02	0.0	0.3	Overburden										
	0.5	5.2	GP	65	33	2	180	15	1	0	FM	**GP (71.0%G, 27.1%S, 1.9%F)**	
23-03	0.0	0.5	Overburden										
	0.5	5.2	GP	60	38	2	200	10	5	0	FM	**GP (74.0%G, 24.7%S, 1.3%F)**	
23-04	0.0	0.3	Overburden										
	0.3	5.2	GP	52	46	2	100	1	0	0	MC	**GP 63.1%G, 35.6%S, 1.3%F)**	Test Pit sluffing in
23-05	0.0	2.0	Overburden										Previous stripping disposal area
	2.0	4.5	GP	52	46	2	100	<1	0	0	MC	**GP (77.1%G, 21.4%S, 1.5%F)**	Test Pit sluffing in
23-06	0.0	0.1	Overburden										
	0.1	4.2	GP	60	38	2	175	15	2	0	FM	**GP (62.8%G, 34.6%S, 2.6%F)**	
	4.2	5.4	SP	10	86	4	25	0	0	0	FM	**SPSM (11.3%G, 82.5%S, 6.2%F)**	
23-07	0.0	0.5	Overburden										
	0.5	5.0	GP	60	38	2	150	<1	0	0	FM	**GP (72.3%G, 26.3%S, 1.4%F)**	
	5.0	6.0	SPSM	20	70	10	25	0	0	0	FM	**SPSM (23.1%G, 63.6%S, 13.3%F)**	Some silt lumps interbedded
23-08	0.0	0.1	Overburden										
	0.1	4.6	GP	65	32	3	175	15	2	0	FM	**GP (72.5%G, 26.23S, 1.2%F)**	
	4.6	6.0	SP	35	62	3	100	2	0	0	FM		Test Pit sluffing in
23-09	0.0	0.6	Overburden										
	0.6	2.8	GP	65	32	3	175	10	3	0	FM		
	2.8	6.0	SM3	0	70	30	-	0	0	0	F		
23-10	0.0	0.1	Overburden										
	0.1	3.0	SM3	0	70	30	-	0	0	0	F		
	3.0	5.0	SM2	0	80	20	-	0	0	0	F		Some rocks at bottom of Test Pit
23-11	0.0	0.1	Overburden										
	0.1	0.5	GP	60	38	2	150	5	0	0	FM		
	0.5	0.9	SP	30	67	3	25	0	0	0	FM		
	0.9	1.0	Volcanic Ash										
	1.0	1.2	SP	30	67	3	25	0	0	0	FM		
	1.2	1.4	Volcanic Ash										
	1.4	4.0	GP	60	37	3	175	5	<1	0	FM	**GP (60.7%G, 37.6%S, 1.7%F)**	
	4.0	5.2	SP	30	67	3	175	<1	0	0	FM		
23-12	0.0	0.4	Overburden										
	0.4	3.0	GP	60	37	3	175	5	<1	0	FM	**GP (67.4%G, 31.5%S, 1.1%F)**	
	3.0	4.0	GP	60	37	3	250	10	2	0	FM		
	4.0	4.5	GP	60	37	3	175	5	<1	0	FM		Some clay lumps mixed in with granular material
	4.5	5.5	SP	30	67	3	50	0	0	0	FM		
23-13	0.0	0.1	Overburden										
	0.1	5.5	GP	65	32	3	175	15	5	0	FM	**GP (73.4%G, 25.2%S, 1.4%F)**	Test Pit sluffing in
23-14	0.0	0.3	Overburden										
	0.3	5.5	GP	65	32	3	175	10	5	0	FM	**GP (67.9%G, 28.9%S, 3.2%F)**	Some minor clay lumps at approximately 3.0 m

23-16	0.0	0.7	Overburden										
	0.7	6.0	GP	65	32	3	175	15	2	0	FM	**GP (68.1%G, 29.8%S, 2.1%F)**	One clay lump observed in Test Pit spoil
23-18	0.0	0.2	Overburden										
	0.2	5.5	GP	65	33	2	175	15	2	0	MC	**GP (71.4%G, 27.2%S, 1.4%F)**	
	5.5	5.6	GP	65	33	2	175	15	2	0	MC		Minor clay lumps
23-17	0.0	0.2	Overburden										
	0.2	5.5	GP	65	33	2	175	10	5	0	MC	**GP (71.6%G, 27.5%S, 0.8%F)**	
	5.5	6.0	GP	65	33	2	175	10	5	0	MC		Some clay mixed with gravel
23-18	0.0	0.7	Overburden										
	0.7	5.0	GP	65	32	3	175	10	5	0	FM	**GP (75.7%G, 22.1%S, 2.2%F)**	
	5.0	8.0	ML/CL										
23-19	0.0	0.4	Overburden										
	0.4	5.0	GP	65	32	3	175	15	10	0	FM	**GP 71.4%G, 27.1%S, 1.5%F)**	
	5.0	5.5	ML/CL										Mixed with some gravel
23-20	0.0	1.2	Overburden										
	1.2	5.5	GP/GC										Gravel intermixed with clays
23-21	0.0	1.8	Overburden										
	1.8	2.8	SM2	0	80	20	F						
	2.8	5.5	GP	63	35	2	FM	250	15	10	0		
	5.5	6.0	SM1	30	58	12	F	25					
23-22	0.0	0.1	Overburden										
	0.1	1.8	GP	50	48	2	FM	50	0	0	0		Pea gravel
	1.8	6.0	SM2	0	80	20	FM						
23-23	0.0	5.0	SP	40	58	2	FM	150	2	0	0	**GP/SP (49.2%G, 48.2%S, 2.5%F)**	
23-24	0.0	0.9	Overburden										
	0.9	5.5	GP	60	38	2	FM	350	0	0	<1	**GP (65.1%G, 34.4%S, 0.5%F)**	One large boulder encountered

Site Photographs:

Test Pit 23-01 Spoil (Clean, coarse sand and gravel 1.5-5.2m)

Test Pit 23-02 Spoil (Clean, coarse sand and gravel 0.5-5.2m)

Test Pit 23-03 Spoil (Clean, coarse sand and gravel 0.5-5.2m)

Test Pit 23-05 Spoil (Clean, coarse sand and gravel 2.0-4.5m)

Test Pit 23-06 Spoil (Clean coarse sand and gravel 0.1-4.2m)

Test Pit 23-06 Spoil (High fines sand 4.2-5.4m)

Test Pit 23-07 Spoil (Clean, coarse sand and gravel 0.5-5.0m)

Test Pit 23-07 Spoil (Silt lumps mixed with gravel 5.0-6.0m)

Test Pit 23-08 Spoil (Clean, coarse sand and gravel 0.1-4.6m)

Test Pit 23-08 Spoil (Clean, gravelly sand 4.6-6.0m)

Test Pit 23-09 Spoil (High fines sand 2.8-6.0m)

Test Pit 23-10 Spoil (High fines sand 0.1-5.0m)

Test Pit 23-11 Spoil (Clean, coarse sand and gravel 1.4-4.0m)

Test Pit 23-12 Spoil (Clean, coarse sand and gravel 0.4-4.0m)

Test Pit 23-12 Spoil (Clay mixed with gravel 4.0-5.5m

Test Pit 23-13 Spoil (Clean, coarse sand and gravel 0.1-5.5m)

Test Pit 23-14 Spoil (Clean, coarse sand and gravel 0.3-5.6m)

Test Pit 23-14 Spoil (Minor clay lumps at approximately 3.0m)

Test Pit 23-15 Spoil (Clean coarse sand and gravel 0.7-6.0m)

Test Pit 23-16 Spoil (Clean, coarse sand and gravel 0.2-5.5m)

Test Pit 23-17 Spoil (Clean, coarse sand and gravel 0.2-5.5m)

Test Pit 23-17 Spoil (Clay mixed with gravel from 5.5 to 6.0m)

Test Pit 23-18 Spoil (Clean, coarse sand and gravel 0.7-5.0m)

Test Pit 23-19 Spoil (Clean, coarse sand and gravel 0.4-5.0m)

Test Pit 23-19 Spoil (Silt and clay mixed with gravel 5.0-5.5m)

Test Pit 23-20 Spoil (Sand and gravel mixed with large clay lumps 1.2-5.5m)

Test Pit 23-21 Spoil (Clean, coarse sand and gravel 2.8-5.5m)

Test Pit 23-21 Spoil (High fines sand 5.5-6.0m)

Test Pit 23-22 Spoil (High fines sand 1.8-6.0m

Test Pit 213-23 Spoil (Clean, sandy gravel 0.0-5.0m)

Test Pit 23-24 Spoil (Clean, coarse sand and gravel 0.9-5.5m)

Phase 1 Mining Area (lower terrace looking south)

Phase 2 Mining Area (Upper terrace looking south)

Closure:

Discussions and recommendations presented above are based on a field investigation. This report has been prepared for use by the Ministry of Transportation and Infrastructure, which includes the distribution as required for purposes for which the assessment was commissioned. The assessment has been carried out in accordance with generally accepted geotechnical practice. Geotechnical judgment has been applied in developing the recommendations in this report. No other warranty is made, either expressed or implied.

Sitkum Consulting Ltd. trusts that the information presented above meets your current requirements. If you have any questions, or require further information, please do not hesitate to contact the undersigned

Sincerely,

[redacted]

Bryan James
Project Manager
Sitkum Consulting Ltd.